Brain MRI Segmentation & Classification using ANN- Review

Shilpa B. Sanghavi[1] Dr.Mrs. R.J. Shelke[2]
[1,2]Department of Electronics Engineering
[1,2]Walchand Institute of Technology, Solapur, India

Abstract— Automatic defects detection in MR images is very important in many diagnostic & Therapeutic applications. Because of high quantity data in MR images and blurred boundaries, tumor segmentation and classification is very hard. This work has introduced one automatic brain tumor detection method to increase the accuracy and yield and decrease the diagnosis time. The goal is classifying the tissues to two classes of normal and abnormal. Decision making involves- i] Feature extraction ii] classification. This paper discuss on various techniques incorporated for detection of brain tumor. Also by using different techniques for feature extraction and classification of tumors into normal & abnormal can be done.

Key words: MR Images, Feature Extraction, Neural Network (NN)

I. INTRODUCTION

Brain tumor is any mass that results from an abnormal and an uncontrolled growth of cells in the brain. Its threat level depends on a combination of factors like the type of tumor, its location, its size and its state of development. Brain tumors can be cancerous (malignant) or non-cancerous (benign). Benign brain tumors are low grade, non-cancerous brain tumors, which, grow slowly and push aside normal tissue but do not invade the surrounding normal tissue. Whereas, malignant brain tumors are cancerous tumors, which grows rapidly and invade the surrounding normal tissues.

Many diagnostic imaging techniques can be performed for the early detection of brain tumors such as Computed Tomography (CT), Positron Emission Tomography (PET) and Magnetic Resonance Imaging (MRI). Compared to all other imaging techniques, MRI is efficient in the application of brain tumor detection and identification, due to the high contrast of soft tissues.

Computer-aided detection or diagnosis (CAD) system effectively detects and diagnoses the cancer in their early stages.CAD systems can play a key role in the early detection of cancers and helps to reduce the death rate with cancer. Hence CAD systems and related techniques have attracted the attention of both research scientists and radiologists. CAD is nothing but the procedures in medical science that assists the doctor in the interpretation of medical images. Imaging techniques in X-ray, CT, MRI, and Ultrasound diagnostics yield a great deal of information, which the radiologist has to analyze and evaluate comprehensively in a short time.

II. RELATED WORK

A computer based method for defining tumor region in the MRI brain images is presented by V.Amsaveni, et. [2]. in this paper, a brain tumor detection method using preprocessing, Gabor feature extraction and BPN classification is proposed. The features are used to train and classify the brain tumor employing Artificial Neural Network classifier. The system can be tested with different images. The experiment result shows the classification accuracy of 89.9%.

The traditional method for detecting the tumor diseases in the human MRI brain images is done manually by physicians. Automatic classification of tumors of MRI images requires high accuracy, since the non-accurate diagnosis and postponing delivery of the precise diagnosis would lead to increase the prevalence of more serious diseases. To avoid that, an automatic classification system is proposed for tumor classification of MRI images [7]. This work shows the effect of neural network (NN) and K-Nearest Neighbor (K-NN) algorithms on tumor classification. The results show that this approach achieves 100% classification accuracy using KNN and 98.92% using NN.

D.Shridhar, IV.Murali Krishna [8] used the Probabilistic Neural Network with Discrete Cosine Transform for Brain Tumor Classification. Decision making was performed in two steps, i) Dimensionality reduction and Feature extraction using the Discrete Cosine Transform and ii) classification using Probabilistic Neural Network (PNN). Evaluation was performed on image data base of 20 Brain Tumor images. The proposed method gives fast and better recognition rate when compared to previous classifiers. The main advantage of this method is its high speed processing capability and low computational requirements.

Shobhana,et[9] made a comparative study of transform techniques namely Discrete Cosine Transform (DCT), Discrete Wavelet Transform (DWT) each separately combined with the Probabilistic Neural Network (PNN) is used for the classification of brain tumor. The system consists of 3 stages for the diagnosis of brain tumor. In the first stage, MR image is obtained and preprocessing is done to remove the noise and sharpen the image. In the second stage, DCT and DWT is used for feature extraction .In the third stage, Probabilistic Neural Network with Radial Basis Function distinguishes brains abnormality. Finally the performance of DCT and DWT in diagnosing the brain tumor is compared using the parameters such as sensitivity rate and precision rate.

It is of great importance to early detect abnormal brains, in order to save social resources. However, potential of wavelet decomposition is not fully explored and widely used. The wavelet-energy was a successful feature descriptor that achieved excellent performance in various applications. The approach from Sahar Ghanavati, et [10] consisted of a three-stage system, including wavelet decomposition, energy extraction, and support vector machines. The results of proposed approach showed its performance was comparable with state-of-the-art algorithms. In addition, it provided a new means to detect features indicative of abnormal brains.

The contributions of this paper lie in following aspects :(i) A new approach for automatic classification of MR Images as normal or abnormal using WT, Wavelet-Energy and SVM classifier is proposed. (ii) The proposed classifier reaches a specificity of 100%. (iii) Wavelet-Energy

is an important and effective feature for MR brain image classification. In this study, a new approach for automatic classification of MR Images as normal or abnormal using Wavelet-Energy and SVM is proposed. The results show that the proposed method gives comparable results with latest methods presented in the literature, but the proposed approach gives a specificity of 100%. It suggests that our three-step algorithm is a promising for image classification in a medical imaging application. This automated analysis system, which requires much lighter computational time, could be further used for classification of image with different pathological condition, types and disease status.

III. METHODOLOGY

The system for tumor detection from MRI brain images is shown in figure 1. It involves preprocessing, feature extraction, classification with neural network training.
The block diagram for proposed system is as follows-

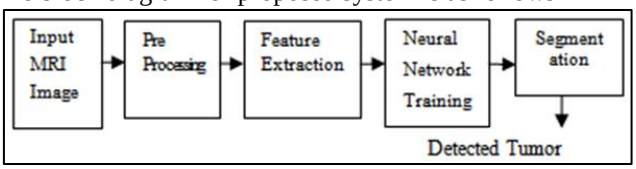

Fig.1: Block diagram of the system

A. Preprocessing

The input MRI images acquired for brain tumor detection are preprocessed to improve the accuracy of tumor detection. The histogram of the input image is equalized to enhance the images.

B. Feature Extraction

Features extraction are identifying relevant features leads to faster easier, and better to understand images. Feature extraction affects significantly the quality of the classification process. MRI texture contains a rich source of information such as characterize brightness, slope, size, and other features[3][4] .After the preprocessing stage various texture features such as entropy, standard deviation, kurtosis etc. are extracted from the images. Wavelet Transform is capable of representing textures at the most suitable scale.

C. Classification

Classification is a computational method used to find patterns and develop classification schemes for data in very huge datasets.

D. Artificial Neural Network

An artificial neural network (ANN), usually called neural network (NN), is a mathematical model or computational model that is inspired by the structure and/or functional aspects of biological neural networks. It consists of an interconnection of simple components referred to as neurons, which are programming constructs that mimic the properties of biological neurons. ANNs consist of one or more layers. Each layer has one or more neurons. The neuron (perceptron) can be defined simply as a device with many inputs, one output, and an activation function. The neurons are connected by directed links. Each link has a numeric weight associated with it from which weighted sum can be calculated. Then after classes can be distinguished by using activation function.

IV. CONCLUSION

The proposed work will report an algorithm which will design, develop, and evaluate an automated screening system for Brain tumor detection. The proposed approach for Brain Tumor Detection will be based on artificial neural network composed of a brain tumor detection method using preprocessing, feature extraction, segmentation and classification. The purpose is to develop tools for discriminating the two classes normal and abnormal from MRI images and assist on decision making in clinical diagnosis and this will help doctor to take or analyze in which stage of cancer the patient have and according to which he/she can take necessary and appropriate treatment steps.

REFERENCES

[1] M. T. Hagan, H. B. Demuth, and M. H. Beale, Neural network design. PWS Pub, 1996.
[2] V.Amsaveni, N.Albert singh, "Detection of brain tumor using neural network," IEEE-31661.
[3] R. M. Haralick, K. Shanmugam, and I. Dinstein, "Textural features for image classification," IEEE Transactions on Systems, Man and Cybernetics, vol. 3(6), Nov. 1973, pp. 610-621, doi:10.1109/TSMC.1973.4309314.
[4] R. M. Haralick, "Statistical and structural approaches to texture," Proceedings of the IEEE, vol. 67(5), May 1979, pp. 786-804, doi: 10.1109/PROC.1979.11328.
[5] Akram M.U, Usman M, "Computer aided system for brain tumor detection which described Magnetic resonance (MR) image", IEEE Trans, on Biomedical Engg, Vol 3, No5.pp. No. 299 - 302, 2011.
[6] D.F Specht, "Probabilistic Neural Networks", Vol.3, No 1, pp. 109-118, 1990.
[7] Amer Al-Badarneh, Hassan Najadat , "A Classifier to detect Tumor Disease in MRI Brain Images" IEEE/ACM International conference on Advances in social Networks Analysis And Mining,2012.
[8] D.Shridhar, IV.Murali Krishna, "Brain Tumor Classification Using Discrete cosine Transform and probabilistic Neural Network " International conference on signal processing, image processing and pattern Recognition [ICSIPR], 2013.
[9] Shobhana G,Ranjith Balakrishnan, "Brain Tumor Diagnosis From MRI Feature Analysis-A comparative study",IEEE sponsored 2nd International conference on Innovations in Information Embedded and communication systems ICIIECS',2015.
[10] Sahar Ghanavati, Junning Li, Ting Liu, Paul S.Babyn, wendy Doda, George Lampropoulos, "Automatic Brain tumor Detection in magnetic resonance images", IEEE-2012.
[11] Othman, Mohd Fauzi, and Mohd Ariffanan Mohd Basri. "Probabilistic neural network for brain tumor classification." Intelligent Systems,Modelling and Simulation (ISMS), 2011 Second International Conference on. IEEE, 2011.

