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Novel Approach In Brain Tumor Classification Using Artificial Neural Networks

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Abstract

Brain tumor is one of the serious disease causes death among the people. Tumor is an uncontrolled growth of tissue in any part of the body. In this work we are taking MR images as input; MRI i.e. is directed into internal cavity of brain and gives the complete image of brain. A Brain tumor detection and classification system is introduced in this paper. The system uses image processing and neural network techniques to detect tumor and to classify the type of tumor. The histogram equalization, image adjustment, thresholding functions are used for detection of tumor. BW label function is used for the determination of centroid of the tumor. Dilate operator are also used to make boundaries of the tumor look continues. In this paper Neural network methods are used for classification of tumor in MR images. In the neural network we are using back propagation method .The two layer feed forward network is trained with back propagation for the classification of tumors.

Keywords: Brain tumor, MRI, ANN.

I. INTRODUCTION

Brain tumors are two types one is primary tumor and second one is secondary tumor. The tumor cell is present within skull and grows within skull is called primary tumor. Malignant brain tumors are primary brain tumors. The tumor presents outside the skull and enter into the skull region called secondary tumor. Metastatic tumors are examples of secondary tumors [1]. The tumor takes up place in the skull and interferes with the normal functioning of the brain. Tumor shifts the brain towards skull and increases the pressure on the brain. Detection of tumor is the first step in the treatment [1].

Brain contains more number of cells that are interconnected to one another .Different cells controls different parts of the body. Some cells control the leg movement. likewise others cells of the brain controls other parts in the body .Brain tumors may have different types of symptoms ranging from headache to stroke, so symptoms will vary depending on tumor location .Different location of tumor causes different functioning disorder[1].

The general symptoms of brain tumor

1) Headache in early mornings.
2) Gradually loss of movement in leg.
3) Loss of sensation in arm.
4) Loss of vision in one or both eyes.
5) Speech difficulty.

Magnetic Resonance Imaging (MRI) is widely used in the scanning.The quality of image is high in the MRI. The quality of image is main important in brain tumor. MRI provides an unparallel view inside the human body [2-6]. In MRI we can see detailed information exordinarly compared to any other scanning like X-ray, C.T scans. The contrast of tumor cell is high compared to normal brain cell.

Treatments techniques for the brain tumor

1) Surgery
2) Radiation therapy
3) Chemotherapy

In the surgery process doctor remove as many as tumor cells from the brain. Radiotherapy is the common treatment used for brain tumors, the beta rays or gamma rays are passed into the brain and applied on the tumor and kill tumor cells. Chemotherapy is one of treatment for brain cancer [1]. In this we are using medicine which controls the tumor cells to reach blood and blood barriers. In chemotherapy the medicine stops the growth of tumor cells and stops the growth normal brain cells. So, in chemotherapy treatment the patients face significant side effects.

The proposed system is an efficient system for detection of tumor and classification for given MRI images .The method of detection and classification work is carried out during the process is explained in the coming section. This method is developed in Matlab simulation environment in order to check for applicability of proposed method.

The following paper has been described in following section. In section II how brain tumor is going to be detected. Tumor classification is described in section III, Results of the Matlab simulation environment are discussed and finally concluded in section V.

II. BRAIN TUMOR DETECTION

The project is processed on brain tumor MRI images for detection and Classification on different types of brain tumors [7-9]. We are going to use image processing techniques in this paper for detection of tumor from MRI images like histogram equalization , image adjustment, image segmentation

are used for Detection of tumor. Fig. 1 explains flow of tumor detection and classification

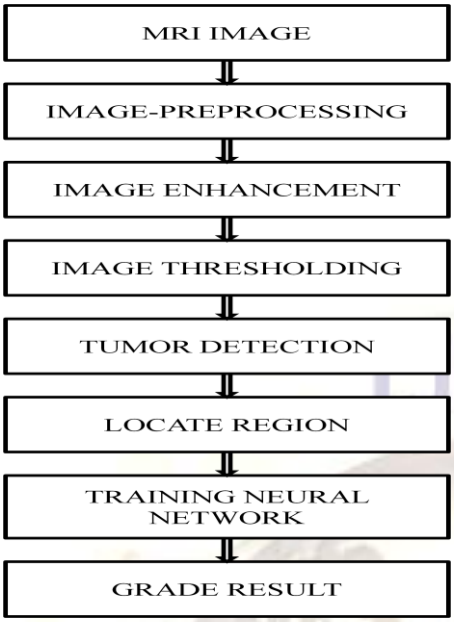

Fig.1 Flow for tumor detection and classification.

The first step in my project is to extract tumor from MRI image. We are going to use various functions one by one for the detection of tumor from MRI image .Generally the MRI images are very dark in nature it is difficult to extract tumor from MRI image The fundamental enhancement is needed. First function is pre-processing of MRI image. In this pre-processing converting colour MRI image into gray colour MRI image. In gray scale image it is easy to identify properties of an image.

The pixel values vary 0 to 255 range in gray scale image .Next step is image enhancement, by using this technique we are increase contrast of an whole image .Histogram equalisation technique is used for image enhancements, and image adjustment is also another image enhancement technique it adjust intensity values of an image.

These techniques increase the contrast of an whole image. Generally the intensity value of brain tumor cell higher than normal brain cell .Tumor is looking brighter in the MRI image. There is contrast difference between whole brain and tumor but human eye can't find the difference. Thresholding is the simple method of image segmentation. Segmentation sub divides an image into sub parts .In this paper our main aim is to separate tumor from the background. Segmentation sub divides an image into sub parts this process is continuous until the edges of the tumor gets detected .The threshold value is calculated from Eqn. (1) considered from [12]. In this paper segmentation is done by the single parameter i.e. intensity thresholding.The intensity value of tumor is higher than normal brain. So, this technique is best suited for the project to detect the tumor from back ground.

The threshold value is compared with the each and every pixel of MRI image. If the threshold value is greater than pixel value of an image then remove that pixel from an image. If the threshold value is lower than pixel value of an image then that will remain as it is (i.e. not removed from the image).

In this we are removing pixel by pixel in the MRI image with the threshold value. After thresholding we get binary image since the MRI image has only two values binary '0'(0),binary value'1'(255).The pixel values of an image greater than threshold value those pixel values set to binary value'1'(255),remaining set as binary '0'(0).The output image is tumor with dark background. While the segmentation there are gaps at the edges dilation operator is used for filling those gap and make continues at the edges.

$$T = \frac{\sum_{i=0}^{M-1}\sum_{j=0}^{N-1} e_{i,j} * M_{i,j}}{\sum_{i=0}^{M-1}\sum_{j=0}^{N-1} M_{i,j}} \quad (1)$$

After tumor detection, now find the centroid of the tumor. BW label function gives the number of connectivities in the MRI image. Which the number of rows and their corresponding columns. The average value of row and average value of columns gives intersection point. This intersection point in the tumor called centroid, then we can locate region in MRI images.

III. TUMOR CLASSIFICATION

A suitable artificial neural network classifier is designed in this paper to identify the different grades of brain tumors. Artificial neural networks are composed of simple elements operated in parallel. These elements are inspired from biological nervous system. Each element in a network called neuron [4-5]. The sum of multiplication of weights and inputs plus bias at the node is positive then only output elements fires. Fire means it discharges energy to next element. Otherwise it doesn't fire.

The artificial neural network is an adaptive system [10-11]. Adaptive means system parameters are changed during the operation. The system parameter is nothing but weights.

Two layer feed forward neural network is taken in this paper .The two layer feed forward neural network consists of one input layer and one output layer and one hidden layer and one output. In the hidden layer 10 nodes are taken .In the two layer feed forward network two log sigmoid transfer function are used.

The two layer feed forward network with two log sigmoid functions are more widely used in classification, pattern recognition .It gives better results in these classification. If the sum of multiplication of weights and input values are greater

than log sigmoid function then output value becomes '1' , otherwise the output value become '0' shown in Fig.2.

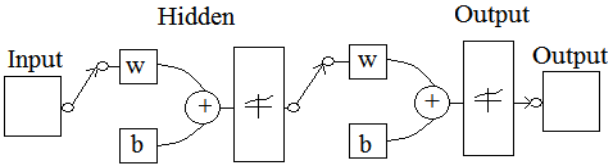

Fig.2 Two layer feed forward network with log sigmoid
transfer function

The two layer feed forward neural network is trained with back propagation learning method .Standard back propagation method is gradient descent method.

As is windrow, hoof learning rule, in which the weights are moved along the negative gradient of performance function. Properly trained back propagated networks gives reasonable results.

The neural network system is designed in two phases.

1) Learning/Training
2) Recognize/Testing

There are four steps in training process

1) Assemble the training data
2) Create the two layer feed forward network
3) Training the network
4) Simulate the network

The known samples are applied to the two layer feed forward neural network is trained with back propagation algorithm .Training/Learning means changing the weights of the network. Change the weights until it gives the proper output. After training the neural network the network parameters are fixed.

In this paper we trained the neural network with 36 MRI brain tumor samples. Total four classifications are in the brain tumors .Each of 9 samples for four different classes. Total 36 input MRI brain tumor samples are trained to neural network through back propagation learning/training. Train the neural network until it gives proper output.

In the second stage i.e. in recognize/testing the unknown samples are applied to the trained network. The trained network compares the unknown sample with the all trained input samples and classifies the unknown sample based on trained input samples. In this paper totally four brain tumor grades exist. Take different known MRI samples for different grades and apply to trained neural network and check whether it is working properly or not. The proposed method gives correct output for the known samples and then it is tested for the unknown samples. The proposed method has given better performance in this paper.

IV. RESULTS

The proposed system efficiently classifies the MRI brain tumor images. The tumor is isolated from the MRI brain images by using above mentioned techniques/ methods**.** The Classification of MRI brain tumor images are also successfully implemented by using artificial neural networks. The proposed system efficiently classifies the brain tumor MRI images into different grades.

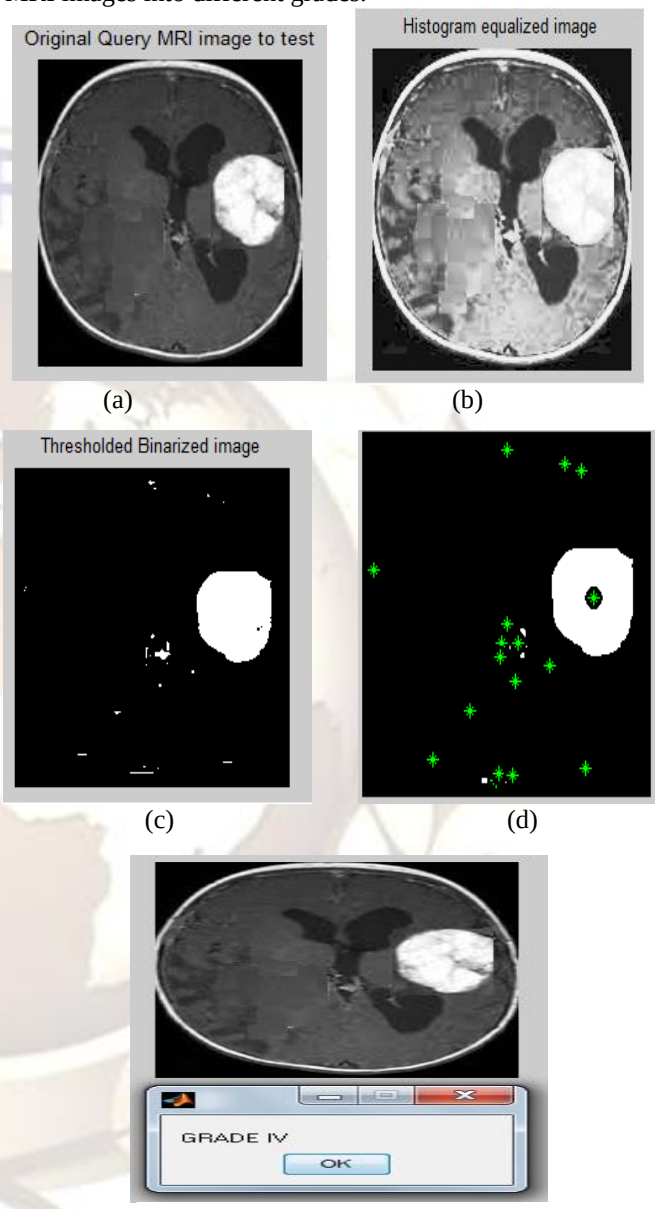

Fig.3 Simulation results (a) Original image (b) Histogram equalized image (c) Binary image (d) Locating tumor region (e) Tumor classification.

V. CONCLUSION

The brain tumor detection and classification is successfully implemented by using the image processing tool box , neural network tool box and graphical user interface .The graphical user interface

is user friendly.The proposed method may be applied for detecting other cancers like breast cancer etc.,

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