AUTOMATED BRAIN TUMOR DETECTION USING BACK PROPAGATION NEURAL NETWORK

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Abstract- Brain tumor is one of the most serious disease occurring among the human beings. This paper describes the proposed strategy to detect & extraction of brain tumor from MRI scan images of the brain. The proposed method is based on back prapogation neural network technique for the classification of MRI image. In particular, it has been developed using image enhancement, segmentation, registration, feature extraction & recognition techniques .In segmentation process it includes the morphological operations and thresholding processs and in neural network technique it performs the training and the testing of imageand it gives the result that the tumor is present or not.

Keywords- MRI Image Data Set, Image Segmentation, Neural Network Technique, Brain Tumor Detection.

I. INTRODUCTION

In early days cancer patients are increasing day by day and it very hard to detect the tumor in early stage, because the diagnosis of tumor is quite difficult. It is identify by the techniques such as chemotherapy, radiotherapy, but these techniques are too costly and not affordable to common people.

In such cases brain tumor detection is carried out by MRI image i.e magnetic resonance image which uses the image segmentation and neural network technique. It gives the effective diagnosis of tumor and it treatment also in suitable cost.

A tumor is a uncontrolled growth of tissue in any part of the body. It creates the uncontrolled cell division usually in the brain. processing segmentation is done and it locates the objects and boundaries of image. Mainly the segmentation is subdivision of image into its constituent regions.

The segmentation is complete when the object is detect and then the neural network technique is start. In this the training and testing of image is done. In training various features of brain tumor is extracted and then these features are tested and matched. And at the end it gives the output that tumor is present or not.

The goal of this paper is to detect the tumor & testing of tumor from various brain MRI images. The section II gives the related work which done by the previous researches. Section III & section IV givesproposed methodology & techniques used..

In this the MRI image take as a input then it converted into gray scale image. After this process Adaptive Histogram Equalization is used to improve the contrast of an image then it performs the morphological operation and thresholding of image. In feature extraction of image Data base get N number of imageand save it then other image can get compare with the data base of image and identifying the tumor is healthy or not.

And last we conclude about the tumor detection.

II. RELATED STUDY

2.1 Classification Of Techniques
There are various existing methods which are based on segmentation process, clustering etc. Some of these methods are as

2.1.1.Fuzzy c-means(FCM)
2.1.2.Support vector machines
2.1.3.K-nearest neighbor

2.1.1.Fuzzy c-means
This is the method of clustering contains one pixel is belong to two or more pixel. In this the pixels are divided into group of “c” fuzzy clusters so it is called as fuzzy c-means.

2.1.2. Support vector machines
It is supervised classifier with associated learning algorithm. It minimized the generalization error. It contains the borderline training so it is called as support vectors.

2.1.3.K-nearest neighbor
KNN algorithm is based on a distance function and voting function.

2.2 Feature Extraction
In a feature extraction the features are extracted from images.

It contains the relevant information and used as a input for classification. The features extracted methods of an image are described below.

2.2.1 Texture features
a.energy
It is known as angular second moment or uniformity and it measures the homogeneity.
b.contrast
It gives the intensity variation of the pixel.

c.correlation
It also gives the intensity variation.

d.entropy
It gives the uncertainty in the random variable.

2.2.2 intensity based feature
These features directly indicates the physical chracteristics of the tissues in brain MRI. The intensity based features include mean, median, skewness etc.

Detection method	Advantages	DisadvantageS
Fuzzy C-Means[4]	It is very simple and fast algorithm provides better segmentation quality.	It considers only image intensity values.
Support Vector Machines(SVM)[3]	It works well in case of high dimensional feature space.	t considers only image intensity values.
K-Nearest Neighbour (KNN)	KNN algorithm is simple to implement.	There is possibility of errorness decision.

III. PRAPOSED METHOD

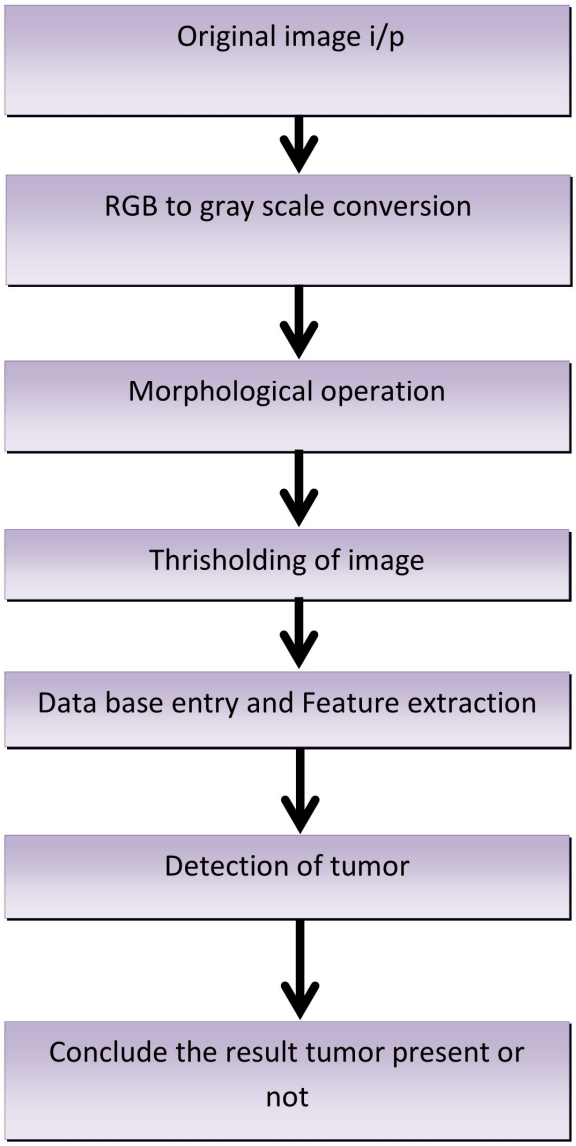
The proposed method consist of image processing, segmentation, training and testing of image by using back prapogation neural network technique.

The algorithm of the method is as following:

3.1RGB to gray conversion
3.2Adaptive Histogram Equalization(AHE).

3.3 Morphological operation.
3.4 Thresholding of image
3.5 Data base training the image
3.6 Identifying the tumor is present in brain or not.

FLOW CHART



3.1.Gray scale image
In our proposed method first we scan the MRI images which are in color. This color image is converted into the gray scale image.

3.2. Adaptive histogram equalization (AHE)
In the adaptive histogram equalization the image is divided into the several rectangular domains. It is use for the enhancement of image. It improves the contrast of image and perform the morphological operations.

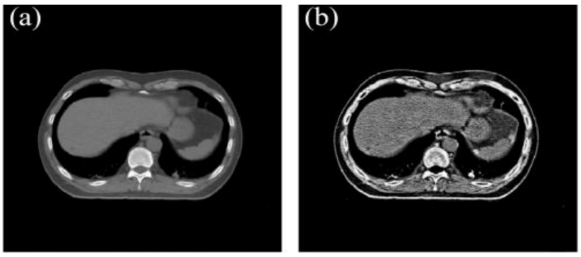


Fig 1.a) original image & b) AHE image

3.3. Morphological operations

Morphological operations is an efficient tool for image processing. There are three basic morphological operations such as

3.3.1.Dilation

Dilation is one of the morphological operation is applied to the binary image it gradually enlarged the boundry of foreground pixel and holes within the area become smaller. To dilate an image the imdilate function is used.

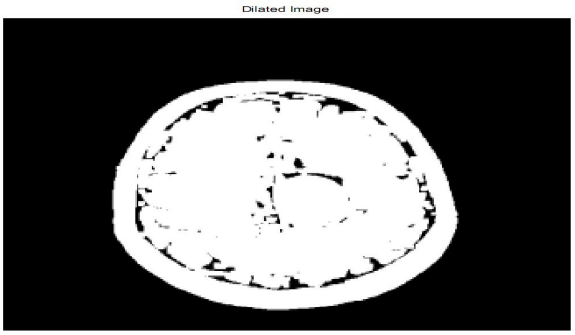


Fig2: Dilation of image

3.3.2..Erosion

Erosion is the operation which is applied to on the binary image. It shrink the size of foreground pixel and holes in the area become larger.To erode an image imerode function is used.

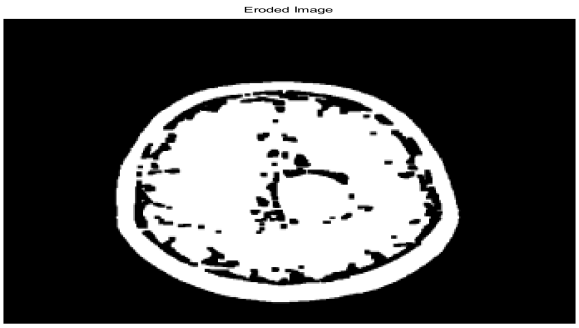


Fig: Erosion of Image

iii.Filling of image

After the dilation and erosion of image the filing of image is done. In this the remaining area of foreground pixels is filled.

3.4.Thresholding of image

It is the method of image segmentation.Inthis the gray scale image is converted into the binary image. In this the otsu method is used to improve the thresholding of image. It containing the image area having the Th> than equal to 80.If value of binary image is greater than 80 then image color is bright and if it is less than 80 the image color becomes dark.

3.4.1Mathematical Expressions:

a.Otsu's method is aimed in finding the optimal value for the global threshold.

It is based on the interclass variance maximization.

M × N image histogram:

L intensity levels, [0, . . . , L − 1];

ni #pixels of intensity i :

$$MN = \sum_{i=0}^{L-1} ni$$

Normalized histogram:

pi $= ni/mn$

pi= $\sum_{i=0}^{L-1}$ pi $= 1$, pi ≥ 0

b.Using k, 0 < k < L − 1, as threshold, T = k:

two classes: C_1 (pixels in [0, k]) and C_2 (pixels in [k + 1, L − 1])

$P_1 = P(C_1) = \sum_{i=0}^{k} pi$ probability of the class C_1

$P_2 = P(C_2) = \sum_{i=k+1}^{L-1} pi = 1 - P1$probability of the class C_2

m_1, mean intensity of the pixels in C_1:

$$m_1 = \sum_{i=0}^{k} i.p(\frac{i}{c1})$$

$$m_1 = \sum_{i=0}^{k} i \frac{p(c_1 i)p(i)}{p(c_1)}$$

$$= \frac{1}{p_1} \sum_{i=0}^{k} i.p_i$$

Where $p(c_1/i)=1$, $p(i)=p_i$ e $p(c_1) = p_1$

c.Similarly, m_2, mean intensity of the pixels in C_2:

$$m_2 = \frac{1}{p_2} \sum_{i=k+1}^{L-1} i.p_i$$

Mean global intensity, m_G :

$$m_G = \sum_{i=0}^{L-1} i.p_i$$

while the mean intensity up to the k level, m:

$$m = \sum_{i=0}^{k} i.p_i$$

Hence:

$P_1m_1+P_2m_2 = m_G$

$P_1 + P_2 = 1$

d.The global variance σ_G^2

$$\sigma_G^2 = \sum_{i=0}^{L-1} (i - m_G)^2.p_i$$

The between-class variance,σ_B can be defined as:

$\sigma_B^2 = P_1(m_1 - m_G)^2 + P_2(m_2 - m_G)^2$

$= P_1P_2(m_1 - m_2)^2$

$= \frac{(m_G P_1 - m)^2}{P_1(1-P_1)} \times$

The goodness of the choice T = k can be estimated as the

$\eta = \frac{\sigma_B^2}{\sigma_G^2}$

e.The quantities required for the computation of ŋ, can be obtained from the histogram:

Hence, for each value of k, ŋ(k) can be computed: $\eta(k) = \frac{\sigma_B^2(k)}{\sigma_G^2}$

$$\sigma_B^2(k) = \frac{(m_G P_1(k) - m(k))^2}{P_1(k)(1 - P_1(k))}$$

The optimal threshold value, k^*, satisfies:

$\sigma_B^2(k^*) = 0 < k < L - 1\sigma_B^2(k) \ldots\ldots\} for\ Max$ [5]

3.5.Data base training the image:
In the data base feed the image according to their brain tumor feature. N number of image we can feed in data base which is taken from medical. The data base image is given below, In feature extraction for data base testing is divided into three parts:

a. Color feature, b. Gray level feature, c. Morphological feature
a. color feature:
In color feature has texture. It is a feature used in the analysis and inter- pretation of image. Texture is described by a set of local statistical properties of pixel intensities.

b. Gray level feature:
In gray level feature having two type i.e. edge mapping and energy. An edge mapping is that process in which fundamental implementation in image process which gives the contour of the object in an image. The result of edge mapping can trace the boundary of the object as well as the curve surface. Edge mapping is used for image segmentation. An energy level find by discrete wavelet transform. The wavelet is powerful mathematical tool for feature extraction of MRI image. The wavelet transform is use for give the information about the signal both in frequency and time domain. DWT is applied on image to get energy level.

c. Morphological feature:
In morphological feature consist two main part i.e. area section and thresholding. An area is that region where tumor is present in the brain. In morphological feature the tumor region can be find and threshold that particular tumor region. Now in tumor region can threshold by 0.2. Threshold Grater then equals to 0.2 that region become bright and all background regions which are less than 0.2 become black.

IV. TECHNIQUES USED

MATLAB is a technical computing environment for high performance numeric computation and visualization. MATLAB integrate numeric analysis, matrix computation, signal processing and graphics in an easy to use environment where problem and solution are expressed just as they are written mathematically without traditional programming. The name matlab stands for matrix laboratory. Matlab was written originally to provide easy access tmatrix software develop by the LINPACK (linear system package) and EISPACK (Eigen system package project. MATLAB is a modern programming language environment. It has sophisticated data structures, contain build in editing and debugging tools, and support object- oriented programming. This factor make matlab an excellent tool for teaching and research.

CONCLUSION

In this paper we include two approaches for brain tumor detection, identification and classification. Our first approach is based on the image processing and segmentation of image and while other is neural network techniques. The proposed algorithm is implemented by using MATLAB software. To improve the thresholding we used otsu's method which is implemented in MATLAB software. In above we are doing the training on the algorithm of image processing and segmentation by using neural network.

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