



# **Brain Tumor Segmentation using Genetic Algorithm with SVM Classifier**

Dr.A.R. Kavitha<sup>1</sup>, L.Chitra<sup>2</sup>, R.kanaga<sup>3</sup>

Professor, Dept. of IT, Jerusalem College of Engineering, Chennai, Tamilnadu, India<sup>1</sup>

UG Student, Dept. of IT, Jerusalem College of Engineering, Chennai, Tamilnadu, India<sup>2</sup>

UG Student, Dept. of IT, Jerusalem College of Engineering, Chennai, Tamilnadu, India<sup>3</sup>

**ABSTRACT:**Brain is the central nervous system of a human being. One of the major causes of death among people is brain tumor. The present paper segments and classifies the MRI brain tumor image as benign or malignant. The methodology involves are Preprocessing ,Segmentation ,Feature Extraction and Classification.The present work segments the tumor using Genetic Algorithm and detects and classifies the tumor using SVM classifier.This helps the doctor to analyse the tumor at earlier stages.The software package used is MATLAB version 13a platform.

**KEYWORDS:** Brain Tumor, MRI Image, Genetic Algorithm, SVM.

## **I.INTRODUCTION**

Brain is a complex organ since it contains more than 10 billion working brain cells .The damaged brain cells are diagnosed themselves by splitting to make more cells.This regeneration takes place in a controlled manner. If regeneration of the cells gets out of control the cells will continue to divide developing a lump which is called Tumor. Brain Tumor is a life threatening disease .The two major classification of tumor are Benign Tumor and Malignant Tumor.Benign Tumor is a non-cancerous cells.It does not causes death or serious injury. Moles are the example of benign tumor.Malignant Tumor is a cancerous cells.This malignant tumor tends to grow and spread in a rapid and uncontrolled way that can cause death and the Tumor are graded according to how aggressive. They are as

- A. Low Grade Tumor(Benign stage)
- B. High Grade Tumor(Malignant stage)

Some research shows that people affected by brain tumor died due to their inaccurate detection.Computed Tomography(CT),Magnetic Resonance Imaging(MRI),Positron Emission Tomography(PET),Single Positron Emission Computed Tomography(SPECT) are some of the imaging technique used majorly to identify diseases. Using these scanners doctors are able to easily visualize and locate the particular portion or area where the disease is being affected and finally to detect them.MRI is a diagnosing tool for detection of tumor in brain and it gives anatomical structure of brain. MRI uses magnetic field to capture image of brain instead of X-Rays.

The major drawback existing in this system of scan is misalignment may occur sometimes during locating the portion, as the image is rotated to 130 degree. Current clinical methods that are used to differentiate the tumor from normal tissues, even after the injection of a contrast medium, may not detect the tumor in boundaries of the MRI brain image.The proposed system overcome such location of misalignment during rotation .

## **II.LITERATURE SURVEY**

A lot of research has been studied for brain tumor segmentation.some of the recent research methods are discussed here. Kamal Kant Hiran, Ruchi Doshi[2] this paper outlines labwork using Artificial neural network for brain tumor detection using MRI images.This paper detects tumor area by darkening tumor portion and enhances the images for detection of brain tumor.The methods used are Image Acquisition,Preprocessing,Image Enhancement,Thresholding and Morphological operation.Medium filter is used in preprocessing to remove noise . A high pass filter is applied to digitized MRI image to get Enhanced image. The threshold segmentation is based on threshold value which converts Gray scale image into binary image. The purpose of morphological operator is to separate the tumor part of the image.

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U.Vanitha, P.PrabhuDeepak,N.PonNageswaran [6] this paper detects the tumor using morphological image processing. This method is used to locate and identify the size of the tumor.The Otsu's method is used in threshold operation which determines the threshold by splitting the histogram of the input image.In this paper imtool is used to identify the size of the tumor.

C.Logeshwaran,P.Bharathi,M.Gowthami[4] In this paper the method feature extraction is done by hybrid method and naïve bayes is used for detection of tumor and classification method is done by fuzzy c-means algorithm. In this method the transform such as wavelet and quad tree are used. The feature extracted images are fused together and fed to naïve Bayes classifier then finally given to fuzzy c-means segmentation.

GirjaSahu,LalitKumarP.Bhaiya[1]this paper uses two different method for soft computing technique like automatic and semiautomatic.This paper used classifiers such as Backpropogation,radialbasis,learning vector quantization , Neuro fuzzy is to detect the brain tumor .The performance of each classifier is then analysed.

Pauline John[5] This paper includes wavelet decomposition ,textural features extraction and classification methods. Discrete wavelet transform is employed using Daubechies wavelet(db4)s and then Gray level co-occurrence matrix is formed .finally these results are fed to probabilistic neural network for further classification and tumor detection. It is seen from the literature surveythat,there is a need for proper segmentation methodology to detect brain tumor and which reduces work load of doctor and help radiologist to assist for correct detection of disease in MRI.

## III.PROPOSED METHOD

The proposed method uses Genetic algorithm to segment the MRI brain tumorimages.The architecture diagram of the proposed method is shown in Figure 1.

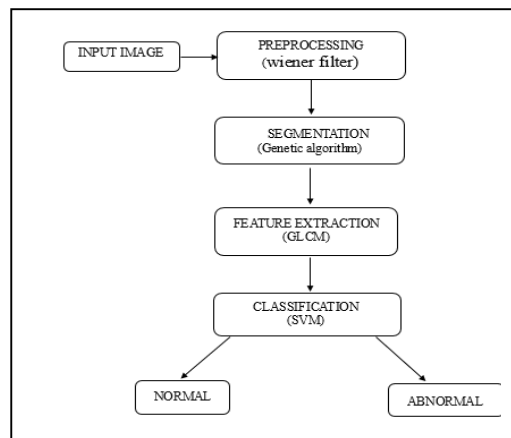


Figure 1.Architecture diagram

The proposed system involves the following modules

- A. Preprocessing
- B. Segmentation
- C. Feature extraction
- D. Classification

### A. PREPROCESSING

Preprocessing is a technique which involves removal of noise or any distortion in an image.Wiener Filter is used in this phase to remove noise. Wiener filter is a 2-D adaptive noise removal filter and it uses pixel wise adaptive wiener method . Wiener estimates the local mean( $\mu$ ) and variance( $\sigma$ ) around each pixel and it is shown in the following equation 1 and 2.

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$$\mu = \frac{1}{NM} \sum_{n1,n2 \in C_\eta} a(n1,n2) \quad (1)$$

$$\sigma^2 = \frac{1}{NM} \sum_{n1,n2 \in C_\eta} a^2(n1,n2) - \mu^2 \quad (2)$$

Where  $\eta$  is the  $N - by - M$  local neighbourhood of each pixel in the image .Wiener then creates a pixel wise wiener filter using these estimates,

$$b(n1,n2) = \mu + \frac{\sigma^2 - v^2}{\sigma^2} (a(n1,n2) - \mu) \quad (3)$$

Where  $v^2$  is the noise variance.

If the noise variance is not given ,wiener uses the average of all the local estimated variances.

## B. SEGMENTATION

Segmentation is a process of partitioning a digital image into multiple regions. Genetic Algorithm is used in this method to segment the images.GA is based on the classical view of a chromosome as a string of genes.

## C. FEATURE EXTRACTION

Feature Extraction is a process of extracting the essential features of an Image in order to classify the various tumor stages.In this module Gray Level Co-occurrence Matrix(GLCM) is used to extract the feature of an image.It is a statistical method for examining the texture feature.The GLCM function characterize the texture of an image by calculating often pairs of pixel with specified value.

## D. CLASSIFICATION

Classification detects the presence of tumor in MRI image and classifies the tumor as benign or malignant or normal.In this module Support Vector Machine(SVM) is used to classify the brain tumor.SVM Support vector machines are mainly two class classifiers, linear or non-linear class boundaries. The idea behind svm is to form a hyper plane in between the data sets to express which class it belongs to. The task is to train the machine with known data and then svm find the optimal hyper plane which gives maximum distance to the nearest training data points of any class.Hyper plane that satisfy the set of points  $x$  can be written as  $w.x+b=0$  , Where  $b$  is scalar and  $w$  is  $p$ -dimensional Vector. The equations for hyper plane can be defined as  $w.x+b=1$  ,  $w.x+b=-1$  . By geometry, the distance between the hyper plane is  $2 / |w|$  . Adding both the hyper plane equations is equivalent to  $y_i (w.x+b) = 1$  The classifier written as  $f(x) = \text{sign}(w.x+b)$  .

## IV.EXPERIMENTS AND RESULT

The proposed paper is initialized with Preprocessing step. In this step noise in an image is removed and quality of an image is improved using wiener filter successfully.The method is developed in MATLAB version 13a platform. The result of the proposed method is shown in Figure 2 and 3.

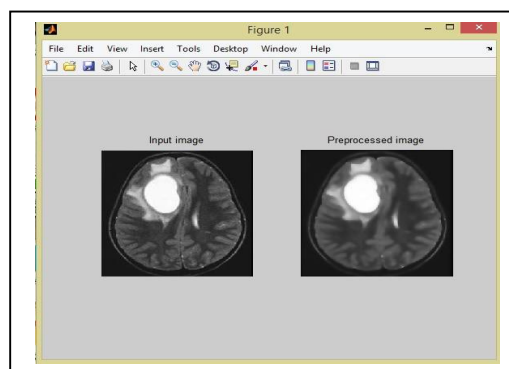


Figure 2 Input and Preprocessed image

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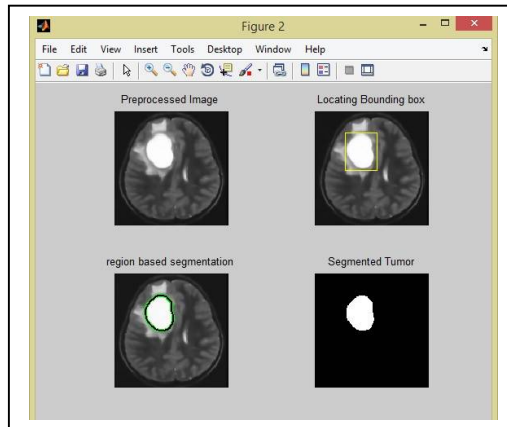


Figure 3 Segmented tumor image

It can be seen from the segmented image that the proposed method segment the tumor part clearly form the given MRI brain image.

The classification is analyzed for set of images collected from publicly available resources and it is shown in the following Table 1

Table 1. Classification Analysis

Image No	Classification output
1	Normal
2	Benign
3	Normal
4	Benign
5	Malignant
6	Malignant
7	Benign
8	Normal
9	Normal
10	Benign

It is seen from the table that the segmented image is correctly classified based on SVM classifier.

## V. CONCLUSION

The proposed method segments and classifies the MRI brain tumor images accurately. Brain tumor is curable if it is caught at earlier stages. This enables the doctors to grasp the exact progression of the disease state, which would help to make a decision about the appropriate treatment, surgery for radiologist and following-up for a series of disease control measures.

## REFERENCES

- [1] Girja Sahu, Lalit Kumar P. Bhaiya. "A Survey Paper Based on the Classification of MRI Brain images using Soft Computing", International Journal of Emerging Technology and Advanced Engineering Techniques" vol.4, pp.1-6, 2014.
- [2] Kamal Kant Hiran, Ruchi Doshi, "An Artificial Neural Network Approach for brain tumor detection using Digital Image Segmentation" ,International Journal of Emerging Trends and Technology in Computer Science, vol. 2, pp.1-15, 2013.
- [3] AR. Kavitha, M. Divya Meena, K. Gayathri, KP. Raghav "Brain Tumor Segmentation using Genetic Algorithm with Modified Region Growing Method", International Journal of Emerging Technology in Computer Science and Electronics, vol.13, pp.1-7, 2015.
- [4] C. Logeshwaran, P. Bharathi, M. Gowthami "Brain Tumor Detection using Hybrid Techniques and Support Vector Machines" International Journal of Advanced Research in Computer Science and Software Engineering, vol. 5, pp.1-8, May 2015.
- [5] Pauline John, "Brain Tumor Classification using Wavelet and Texture based Neural Network", International Journal of Scientific and Engineering Research, vol.3, pp.1-7, 2012.
- [6] U. Vanitha, P. Prabhu Deepak, N. Pon Nagesharan, R. Sathappan. "Tumor Detection in Brain using Morphological Image Processing" Journal of Applied Science and Engineering Methodologies, vol.1, pp.1-6, 2015.