International Journal of Advanced Engineering and Nano Technology (IJAENT)
ISSN: 2347-6389, Volume-1, Issue-5, April, 2014

# Detection of Brain Tumor Using MRI Scan

**Jayashree Bhole, A.M.Patil**

***Abstract— Brain tumor is an abnormal mass of tissue in which some cells grow and multiply uncontrollably, apparently unregulated by the mechanisms that control normal cells. The growth of a tumor takes up space within the skull and interferes with normal brain activity. So detection of the tumor is very important in earlier stages. Various techniques were developed for detection of tumor in brain. The main concentration is on those techniques which use image segmentation to detect brain tumor. These techniques use the MRI Scanned Images to detect the tumor in the brain.***

***Key Terms: - Brain tumor; MRI; Neuro fuzzy logic; Biological analysis.***

## I. INTRODUCTION

In medical imaging, 3D segmentation of images plays a vital role in stages which occur before implementing object recognition. 3D image segmentation helps in automated diagnosis of brain diseases and helps in qualitative and quantitative analysis of images such as measuring accurate size and volume of detected portion.

Accurate measurements in brain diagnosis are quite difficult because of diverse shapes, sizes and appearances of tumors. Tumors can grow abruptly causing defects in neighboring tissues also, which gives an overall abnormal structure for healthy tissues as well. In this paper, we will develop a technique of 3D segmentation of a brain tumor by using segmentation in conjunction with morphological operations.

### *A. Tumor:*

The word tumor is a synonym for a word neoplasm which is formed by an abnormal growth of cells Tumor is something totally different from cancer.

#### *1) Types of Tumor:*

There are three common types of tumor:
*1)* Benign;
*2)* Pre-Malignant;
*3)* Malignant (cancer can only be malignant) [1].

1) *Benign Tumor:* A benign tumor is a tumor is the one that does not expand in an abrupt way; it doesn't affect its neighboring healthy tissues and also does not expand to non-adjacent tissues. Moles are the common example of benign tumors.

2) *Pre-Malignant Tumor:* Premalignant Tumor is a precancerous stage, considered as a disease, if not properly treated it may lead to cancer.

3) *Malignant Tumor:* Malignancy (mal- = "bad" and -ignis = "fire") is the type of tumor, that grows worse with the passage of time and ultimately results in the death of a person.

Malignant is basically a medical term that describes a severe progressing disease. Malignant tumor is a term which is typically used for the description of cancer.

Malignant gliomas are the most common primary brain tumorsof humans, accounting for 30% of all primary central nervoussystem (CNS) tumors in adults; they are divided into two types:
i) anaplastic astrocytoma
ii)glioblastoma multiforme.

Primary malignant brain tumors in the United States areestimated to occur at an incidence of 14.7 per 100,000 people,and 10,000-15,000 new cases are diagnosed annually. Malignant gliomasare ideal candidates for molecular based therapies as: (i) metastases are rare, (ii) imaging studies allow precise monitoring of outcome, and (iii) delivery techniques allow for targeting of therapeutics [08].

## II. PROPOSED SYSTEM

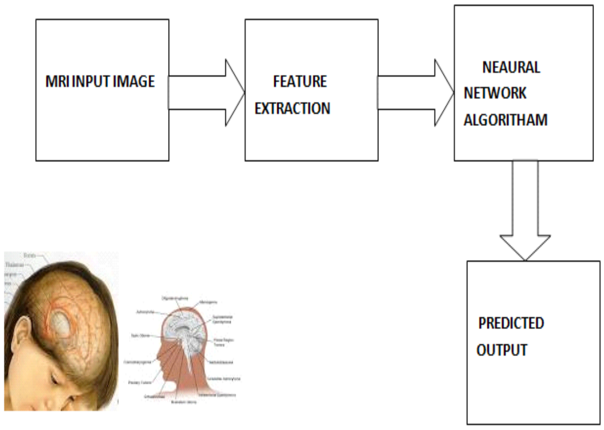


Figure 2.1 Proposed System

### *2.1 MRI Images*

MRI is basically used in the biomedical to detect and visualize finer details in the internal structure of the body. This technique is basically used to detect the differences in the tissues which have a far better technique as compared to computed tomography. So this makes this technique a very special one for the brain tumor detection and cancer imaging [1].

CT uses ionizing radiation but MRI uses strong magnetic field to align the nuclear magnetization then radio frequencies changes the alignment of the magnetization which can be detected by the scanner. That signal can be further processed to create the extra information of the body. Magnetic resonance imaging (MRI), or nuclear magnetic resonance imaging (NMRI), is primarily a medical imaging technique used in radiology to visualize detailed internal structure and limited function of the body[2]. MRI provides much greater contrast between the different soft tissues of the body than computed tomography (CT) does, making it

**Manuscript received April, 2014.**
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especially useful in neurological (brain), musculoskeletal, cardiovascular, and ontological (cancer) imaging. MRI segmentation has been proposed for a number of clinical investigations of varying complexity. Applications of MRI segmentation include the diagnosis of brain trauma where white matter lesions, a signature of traumatic brain injury, may potentially be identified in moderate and possibly mild cases. These methods, in turn, may require correlation of anatomical images with functional metrics to provide sensitive measurements of brain trauma. MRI segmentation methods have also been useful in the diagnostic imaging of multiple [sclerosis], including the detection of lesions, and the quantization of lesion volume using multispectral methods. In order to understand the issues in medical image segmentation, in contrast with segmentation of, say, images of indoor environments, which are the kind of images with which general purpose visual segmentation systems deal, we need an understanding of the salient characteristics of medical imagery. One application of our clustering algorithm is to map and identify important brain structures, which may be important in brain surgery. MRI is an imaging technique used in medical settings to produce high quality images, inside human body. It is more efficiently used in brain scanning.

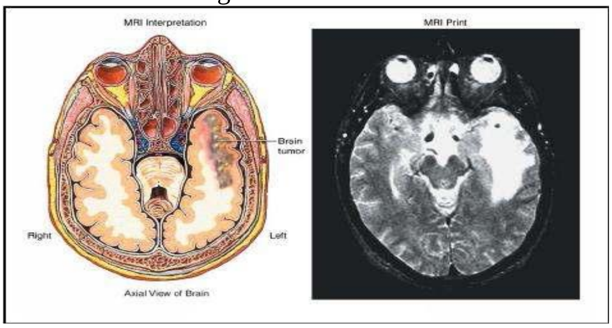


Figure 2.2 MRI Image

## III. LITERATURE SURVEY

Many of the advances in neural networks have had to do with new concepts, such as innovative architectures and training rules. It is just as important as been the availability of powerful new computers on which to test these new concepts. At present, the answer seems to be that neural networks will not only have their day but will have a permanent place, not as a solution to every problem, but as a tool to be used in appropriate situations. In addition, remember that we still know very little about how the brain works. The most important advances in neural networks almost certainly lie in the future. Although it is difficult to predict the future success of neural networks, the large number and wide variety of applications of this new technology are very encouraging.

The usage of Artificial Neural Networks (ANN) to improve the accuracy of the classifiers is illustrated by [09]. The application of various ANN for image classification is analyzed by [10]. The application of Kohonen neural networks for image classification is explored by [11]. Some modifications of the conventional Kohonen neural network are also implemented in this work which proved to be much superior to the conventional neural networks. The modified Probabilistic Neural Network for tumor image classification is used by [12]. A Neuro-Fuzzy Classifier is used to detect candidate circumscribed tumor. ANN'S are networks of interconnected computational units, usually called nodes. The input of a specific node is the weighted sum of the output of all the nodes to which it is connected. The output value of a node is, in general, a non-linear function (referred to as the activation function) of its input value.

## IV. FEATURE EXTRACTION

For the recognition of given query sample five invariant features are evaluated.

For the evaluation of these features, the image is processed through :

- Histogram Equalization
- Binarization
- Morphological Operations
- Region Isolation
- Feature Extraction

The above stated methods are used for both query images & the database images.

### *4.1. Histogram Equalization:*

Histogram equalization is the technique by which the dynamic range of the histogram of an image is increased. Histogram equalization assigns the intensity values of pixels in the input image such that the output image contains a uniform distribution of intensities. It improves contrast and the goal of histogram equalization is to obtain a uniform histogram. This technique can be used on a whole image or just on a part of an image. Histogram equalization redistributes intensity distributions. If the histogram of any image has many peaks and valleys, it will still have peaks and valley after equalization, but peaks and valley will be shifted. Because of this, "spreading" is a better term than "flattening" to describe histogram equalization. In histogram equalization, each pixel is assigned a new intensity value based on its previous intensity level.

### *4.2. Binarisation :*

Image binarization converts an image of up to 256 gray levels to a black and white image. Frequently, binarization is used as a pre-processor before OCR. In fact, most OCR packages on the market work only on bi-level (black & white) images.

The simplest way to use image binarization is to choose a threshold value, and classify all pixels with values above this threshold as white, and all other pixels as black. The problem then is how to select the correct threshold. In many cases, finding one threshold compatible to the entire image is very difficult, and in many cases even impossible. Therefore, adaptive image binarization is needed where an optimal threshold is chosen for each image area. For the equalized image the pixels are represented in a 0 to 255 gray level intensity.

### *4.3 Morphological Operations :*

This is used as a image processing tools for sharpening the regions and filling the gaps for binarized image. The dilation operator is used for filling the broken gaps at the edges and to have continuities at the boundaries. A structuring element of 3x3square matrix is used to perform dilation operation.



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ISSN: 2347-6389, Volume-1, Issue-5, April, 2014

### *4.4 Region Extraction :*

It is required to display accurately the position relations of the extracted tumor and brain area from the MRI image which is used for the diagnosis of the brain tumor. We propose a method of extracting the brain tumor area using MRI images. In our method, after a base image is generated from one of slice image in MRI data, Region Growing method is applied to the selected slice image based on the base image. The area which is obtained by Region Growing method is considered as a new base image in the next step, and this extraction process is repeated for all slice image. Finally, we extracted the area of tumor and brain, and both are visualized in three-dimensional domain simultaneously to understand the position relations of the tumor. Onto the dilated image a filling operator is applied to fill the close contours. To filled image, centroids are calculated to localize the regions as shown beside.

### *4.5 Feature Extraction :*

To the extracted region the feature extraction process is applied for the calculation of 5 invariant features.

•Area
•Homogeneity
•Contrast
•ASM( Angular second moment)
•Entropy

1. Contrast
N-1
f1 = _ Pi,j (i-j )2
i,j=0
2. Angular Second Moment (ASM)
N-1
f2 = _ Pi,j
i,j=0
3.Inverse Difference Moment (Homogeneity)
N-1
f3 = _ Pi,j
i,j=0 i – (i*j)2
4. Area
5. Entropy
N-1
f5 = _ Pi,j (-ln Pi,j )
i,j=0

The above mentioned process is applied on a clustered database consisting of 60 distinct MRI images categorized into 4 classes.

## V. CLASSES OF TUMOR

1) Gliomas class- Slow growing, with relatively well-defined borders.

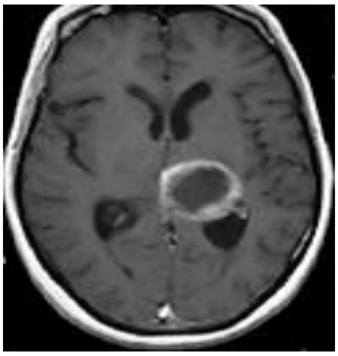

Fig. 5.1: Class 1

Fig. 5.2: Class 1

2) Astrocytoma class - Slow growing. Rarely spreads to other parts of the CNS , Borders not well defined .

Fig. 5.3 : Class 2

Fig. 5.4: Class 2

3) Anaplastic Astrocytoma class - Grows faster .

Fig..5.5: Class 3

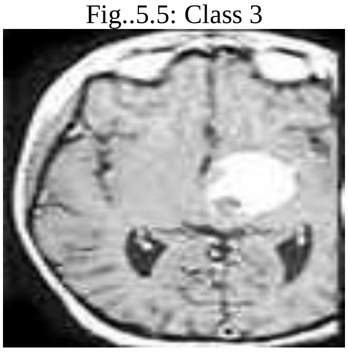

Fig..5.6: Class 3


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4) Glioblastoma multiforme (GBM) class - Most invasive type of tumor, Commonly spreads to nearby tissue, Grows rapidly.

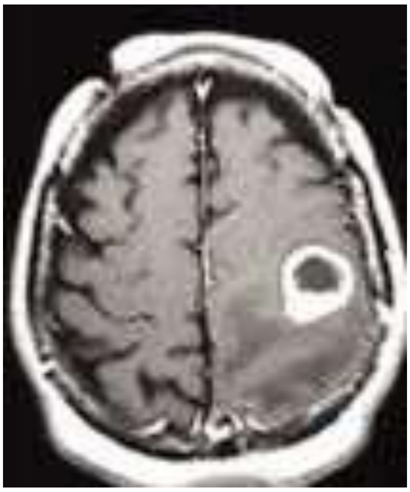

Fig. 5.7: Class 4

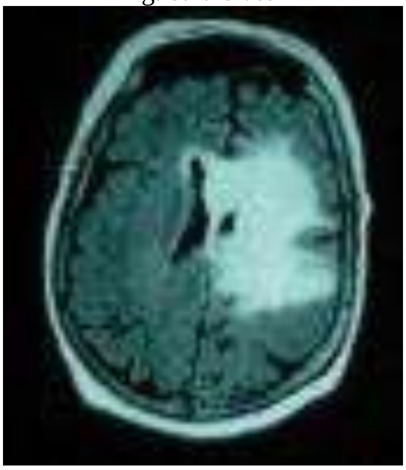

Fig. 5.8 : Class 4

## VI. RESULTS

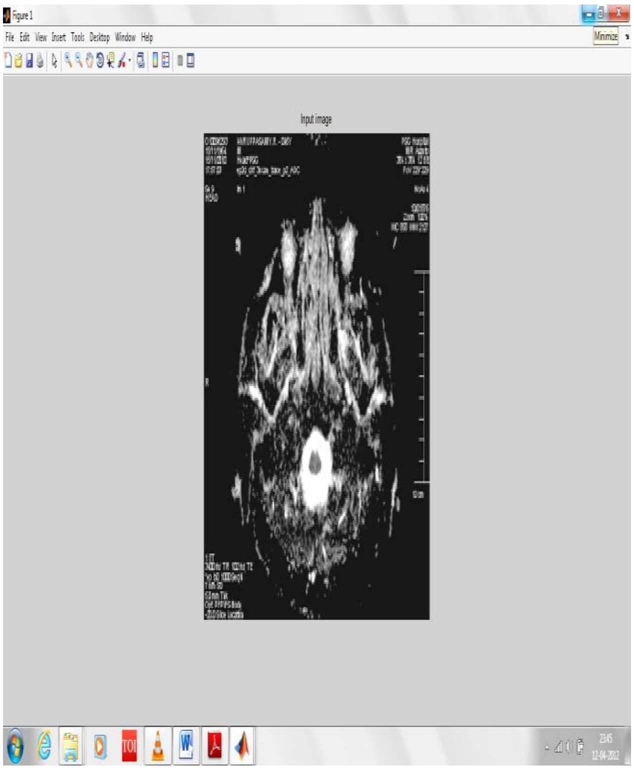

Fig. 6.1 input image

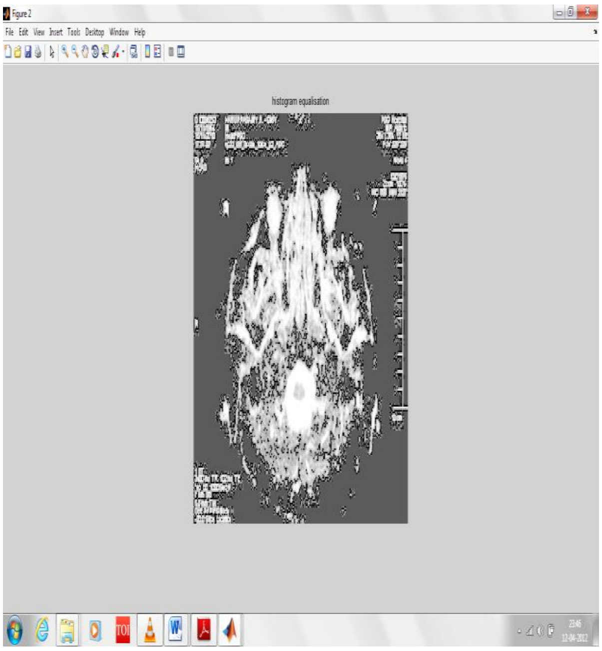

Fig. 6.2 Histogram equalization

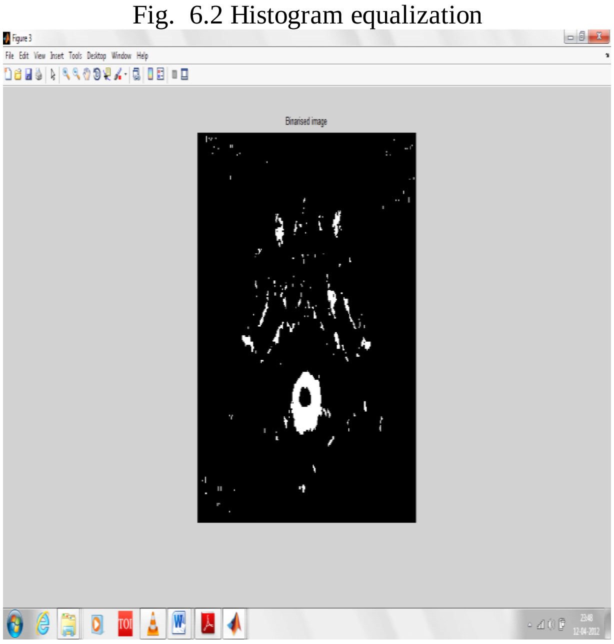

Fig. 6.3 Binarized Image

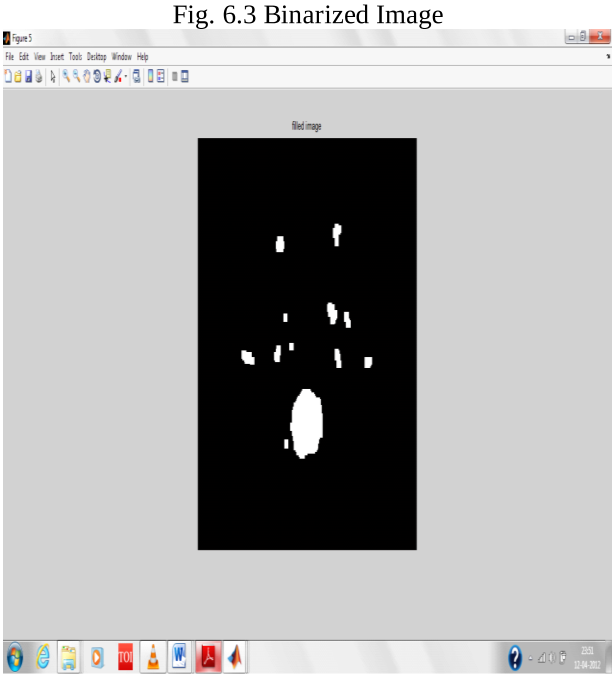

Fig. 6.4 Filled Image



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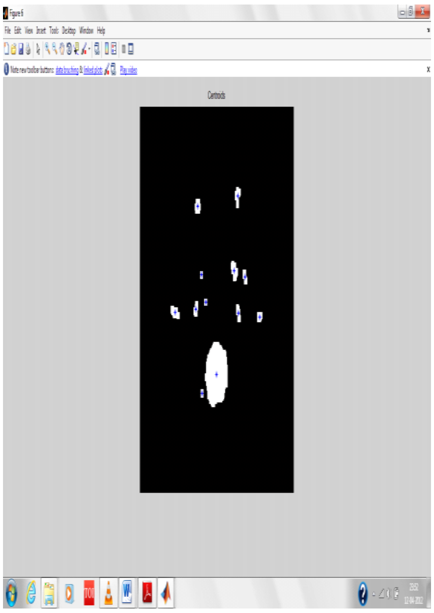

Fig. 6.5 Centroids

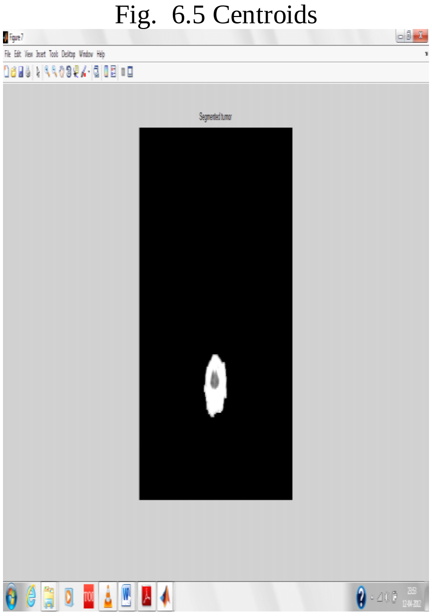

Fig. 6.6 Segmented Tumor

## VII. CONCLUSION

This Research work project presents an automated recognition system for the MRI image using the neuro fuzzy logic. Texture features are used in the training of the neuro-fuzzy model. Co occurrence matrices at different directions are calculated and Grey Level Co-occurrence Matrix (GLCM) features are extracted from the matrices.

It is observed that the system result in better classification during the recognition process. The considerable iteration time and the accuracy level is found to be about 50-60% improved in recognition compared to the existing neuro classifier.

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