Brain Tumor Detection from MRI images

[1]Milind Rane, [2] Dinesh Teli
[1,2]*Department of Electronics Engineering, Vishwakarma Institute of Technology, Pune*

***Abstract*-**In this paper we propose adaptive brain tumor detection. Image processing is used in the medical tools for detection of tumor. Tumor detection using MRI (Magnetic Resonance Imaging) images has become an emergent research area in the field of medical imaging system. An efficient algorithm is proposed in this paper for tumor detection based on morphological operations. Image pre-processing operations are also performed in order to enhance some features of the image. Python-opencv is used as an image processing tool for processing of images. It is expected that the experimental results of the proposed system will give better result in comparison to other existing systems.

Keywords*-Index Terms—MRI; brain tumor; morphological operations; pre-processing.*

I. INTRODUCTION

It is an important to find out tumor from MRI images but it is somewhat time-consuming and difficult task sometime performed manually by medical experts. Large amount of time was spent by radiologist and doctors for identification of tumor and segmenting it from other brain tissues. However, exact labeling brain tumors is a time-consuming task, and considerable variation is observed between doctors. Subsequently, over the last decade, from various research results it is being observed that it is very time-consuming method but it will get faster if we use image processing techniques. Primary brain tumors do not spread to other body parts and can be malignant or benign and secondary brain tumors are always malignant. Malignant tumor is more dangerous and life threatening than benign tumor. The benign tumor is easier to identify than the malignant tumor. Also, the first stage tumor may be malignant of benign but after first stage it will change to dangerous malignant tumor which is life threatening.

Different brain tumor detection algorithms have been developed in the past few years. The main aim of this system is to make an automated system for detecting and identifying the tumor from normal MRI. Most of the early methods obtainable for tumor detection and segmentation may be largely divided into three groupings: region-based, edge-based and fusion of region and edge-based methods. In the proposed methodology, morphological operations along with certain image pre-processing is done for detection of tumor part.

II. RELATED WORK

In recent years many algorithms have been developed for detection of tumor using MRI images. Deepa et. al [1] describes different techniques used by researchers to detect the brain tumor from MRI images. Anam Mustaqeem et. al [2] proposed a method based on threshold segmentation, watershed segmentation and morphological operators. Vipin Y. Borole et. al [3] proposed a review of image processing techniques for brain tumor detection. The preprocessing techniques include different methods like filtering, contrast enhancement, edge detection is used for image smoothing. The preprocessed images are used for post processing operations like threshold, histogram, segmentation and morphological, which is used to enhance the images. Baljinder Singh et. al [4] introduced a new mean shift based fuzzy c-means segmentation algorithm. V. Amsaveni et. al [5] proposed detection of brain tumor using neural network. It included pre-processing, gabor feature extraction and Back propagation network classification. C. Hemasundara Rao et. al [6] proposed an automatic method for tumor detection and segmentation. He used conditional random field based framework to combine the information present in T1 and FLAIR in probabilistic domain. Ahmed Kharrat et. al [7] used mathematical morphology to increase the contrast in MRI images. Then they applied Wavelet Transform in the segmentation process to decompose MRI images. At last, the k-means algorithm is implemented to extract the suspicious regions or tumors. Praveen G.B. et. al [8] used GLCM for feature extraction from MRI images. LS-SVM classifier along with MLP kernel function is used to classify tumorous and non-tumorous images. Fast bounding box algorithm is used as region-based method for tumor segmentation. Padmakant Dhage et. al [9] proposed watershed algorithm for tumor segmentation. Luxit Kapoor et. al [10] performed a survey on image processing techniques for brain tumor detection. The advantages and disadvantages of various segmentation techniques were compared. Parveen et. al [11] proposed a hybrid methodology of combining support vector machine and fuzzy c-means clustering for classification of brain tumor. Devendra Somwanshi et. al [12] devised an efficient tumor detection algorithm using entropy measures. Swapnil R. Telrandhe et. al [13] proposed detection method using K-means algorithm followed by object labelling

algorithm with HOG feature extractor. SVM is used for pattern mapping and pattern matching process.

III. PROPOSED METHOD

The main purpose of this paper is to identify the region of tumor and to do the detailed diagnosis of that tumor which will used in treating the cancer patient. The details about the proposed system is given below.

A. Preprocessing-

The aim of pre-processing is an improvement of the image data that suppresses unwilling distortions or enhances some image features important for further processing.

1) Conversion of RGB image to grayscale

When converting an RGB image to grayscale, we have to take the RGB values for each pixel and make as output a single value reflecting the brightness of that pixel. So as a result, a 3-channel image is converted to a 1-channel image. Advantage of converting RGB to grey is that it reduces complexity i.e. 3-channel image operation boils down to a 1-channel operation.

2) Gaussian filtering

A Gaussian filter is a linear filter. It is used to blur the image or to reduce noise.

3) Thresholding

Image thresholding is a simple way of partitioning an image into a foreground and background. This image analysis technique is a type of image segmentation that isolates objects by converting grayscale images into binary images.

B. Feature detection-

In computer vision and image processing, feature detection includes methods for computing abstractions of imag information and making local decisions at every image point whether there is an image feature of a given type at that point or not. The resulting features will be subsets of the image domain, often in the form of isolated points, continuous curves or connected regions.

C. Morphological Operations-

1) Erosion

The action of erosion operator is equivalent to computing a local minimum over the area of the kernel. As the kernel is scanned over the image, we compute the minimal pixel value overlapped by the structuring element and replace the image pixel under the anchor point with that minimal value.

2) Dilation

In dilation, a small image called structuring element is used as a local maximum operator.

As the structuring element is scanned over the image, we compute the maximal pixel value overlapped by the kernel and replace the image pixel under the anchor point with that maximal value.

IV. PERFORMANCE AND EXPERIMENTS

The algorithm followed for brain tumor detection is as follows-

A. Input MRI image.
B. Convert RGB image to greyscale.
C. Apply gaussian filtering.
D. Apply binary thresholding.
E. Apply morphological erosion.
F. Apply morphological dilation.
G. Contour detection.
H. Output image showing the tumor region.

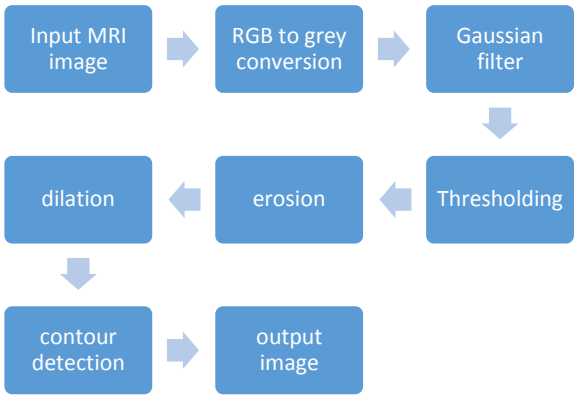

Fig. 1: Block diagram of proposed algorithm

V. RESULTS

The images obtained after performing each operation as suggested in the proposed algorithm is shown below-

A. Input MRI image

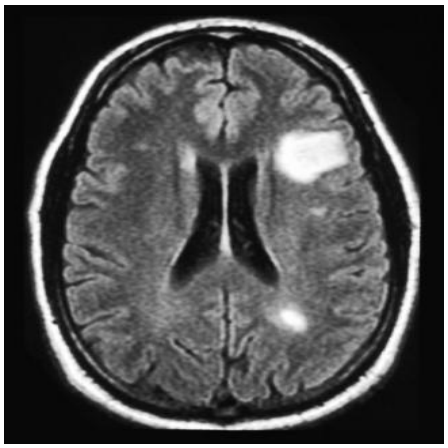

Fig. 2:Input MRI image

Magnetic resonance imaging (MRI) of the brain is a safe and painless test that uses a magnetic field and radio waves to produce detailed images of the brain and the brain stem. An MRI differs from a CAT scan (also called a CT scan or a computed axial tomography scan) because it does not use radiation.

B. Conversion of RGB image to greyscale image

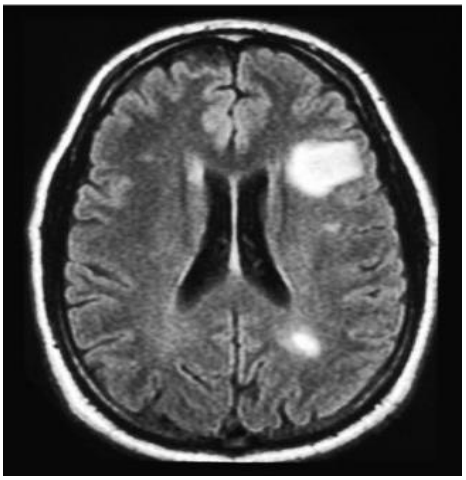

Fig. 3: Greyscale image

C. Applying gaussian filtering to the grey image

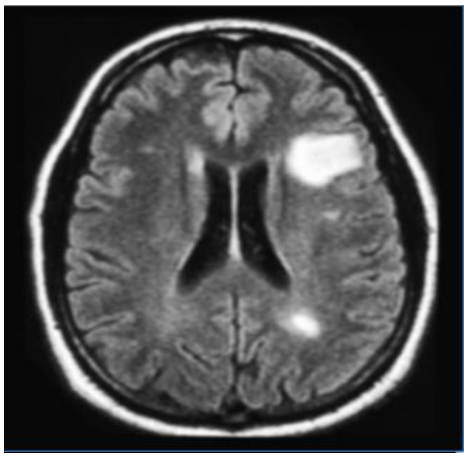

Fig. 4. :Gaussian filtered image

D. Applying thresholding to the filtered image

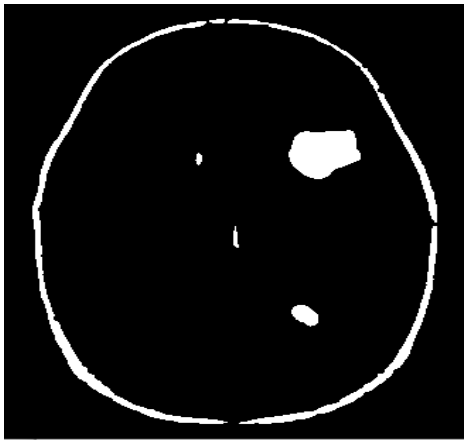

Fig. 5: Thresholded image

E. Applying erosion to the thresholded image

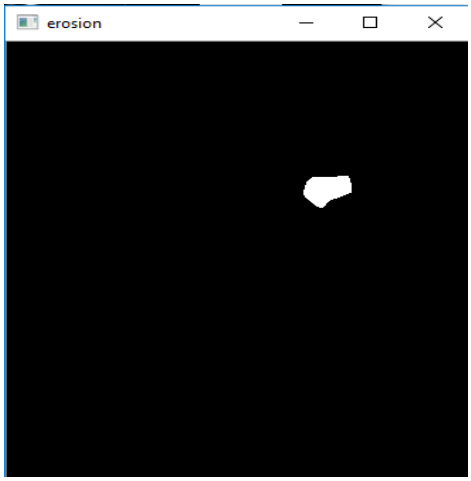

Fig. 6:Eroded image

F. Applying dilation to the eroded image

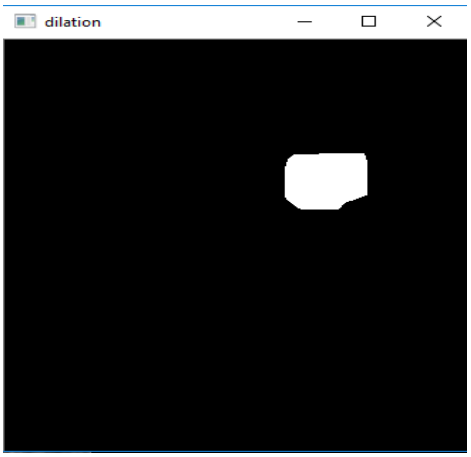

Fig. 7: Dilated image

G. Output image showing the detected tumor

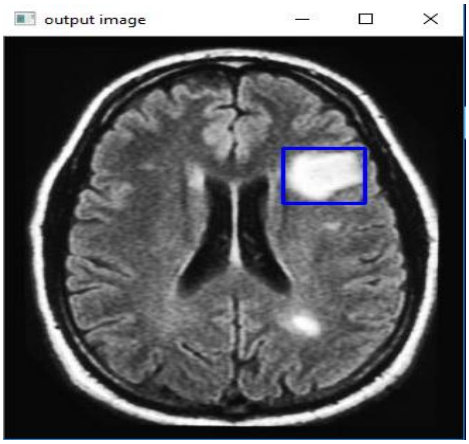

Fig. 8:Output image

Table 1: Performance results of algorithm on a set of images

Performance parameter	Total 100 test images
Correctly detected	85
Incorrect results	15
Accuracy	85%

VI. RESULT ANALYSIS

The results gained through the proposed algorithm are quite accurate. The tumor is successfully detected. The table 1 shows that on a test sample of 100 images, 85 were classified accurately whereas 15 where incorrectly classified. Hence the percentage accuracy gained through above results is 85%.

Python programming along with opencv was used for implementing the algorithm. The speed of execution is good.

VII. CONCLUSION

Brain tumor detection is of utmost importance in medical imaging. The proposed methodology uses preprocessing operations like filtering and thresholding to enhance the features of the input MRI image. The preprocessed image is operated with morphological operations such as erosion and dilation. Finally, the contour detection is applied for detecting the tumor part.

The proposed algorithm was tested on a set of images and was found accurate. Hence image processing has become a very important task in today's world. Applications of image processing can originate in number of areas like medical, remote sensing, electronics and so on.Future scope involves calculation of tumor area and also evaluating tumor type and the stage of tumor.

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