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Image Mining Brain Tumor Detection using Tad Plane Volume Rendering from MRI (IBITA)

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ABSTRACT: ***In this onslaught, a effort has been prepared to encapsulate the information about the brain tumor and an Sushisen algorithm using BRATS 2016 for primary detection of the brain tumor location with the help of image mining. There are different scanning techniques like X-ray, MRI, CT scan. Which are widely used by the radiologist to get information about human body anatomy to analyze the diseases. Modern image mining techniques are helpful for pre mining of scanned images in medical area. Modern image mining techniques improve these scanned images to get more details about human anatomy (Relevance +Accuracy +Time) in earlier stage. Image mining technique can help the physicians and practitioner for diagnoses diseases easily.***
Key words: Enhancement, Tad plane, Volume rendering.

1. INTRODUCTION

Brain tumor is considered as the main cause of cancer death worldwide. Brain tumor can affect people at any age. Brain tumor is embedded in the region of a brain. It can result from development of abnormalities. The earlier detection of tumor is challenging task due to the structure of cells in the brain when that are in overlapped form. The detection of brain tumor, it's location and ability to spread quickly help for proper treatment. Modern image mining technique is one of the tool by which it's become possible to identify the diseases location easily. Modern image mining has advantages like reproducing original data again and again without any change; enhance an image which helps the radiologist for analysis.

According to National Brain Tumor Society, people having primary tumor are about 688,000 and according to Central Nervous System (CNS) in the United States 138,000 people with malignant tumor and 550,000 with nonmalignant tumors. From an estimated 612,000+ people living with primary brain tumor and CNS tumor in the United State in 2004 , 124,000 people suffering from malignant tumors and 488,000 people with nonmalignant tumors. People are affected by tumor in India are near about 80271 (2007 estimates) [1]. The National Cancer Institute (NCI) estimated that 22,070cases of brain tumor and other Central Nervous System (CNS) cancer would be diagnosed in the United State in 2016. The American Brain Tumor Association (ABTA) estimated that 62930 new cases of primary tumor would be diagnosed in 2016[4].

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Basically there are two type of Brain tumor:

1. Primary tumor
2. Secondary tumor

1. Primary tumor: Primary brain tumors are tumors that originates in the brain. They can be cancerous or noncancerous.

The primary tumor has two subtypes:

- **Benign (noncancerous) :**

This benign type of tumor is slow-growing and rarely spread to other areas of the body. It often has well-defined borders. This type of tumor can be removed completely by surgery. There are less chances to come back. It will not spread to other parts of the brain or spinal cord.

- **Malignant (cancerous) :**

This malignant type of tumor is fast-growing and affect the nearby healthy brain cells. This tumor can come back even it is completely removed by surgery. There are chances of spreading this tumor to other parts of the brain or spinal cord.

2. Secondary brain tumor :

This type of cancer has begun in another part of the body such as breast cancer and kidney cancer that spreads to the brain.

The scanning of brain can be done in different way for detection of tumor location in brain. The techniques like magnetic resonance imaging (MRI) and computer tomography (CT) scan are mostly used for getting a information of brain anatomy. Magnetic resonance imaging (MRI) provides more contrast and detail information. Magnetic resonance imaging (MRI) technique classifies cells composed of tissues in human body. MRI provides detail information about abnormalities in soft tissues that are difficult to identified by X-rays and CT scan.[2] So MRI images are mostly referred by the radiologist for effective diagnosis and for the treatment of the diseases . Fig.1 is the MRI scan image of Brain which contains tumor.

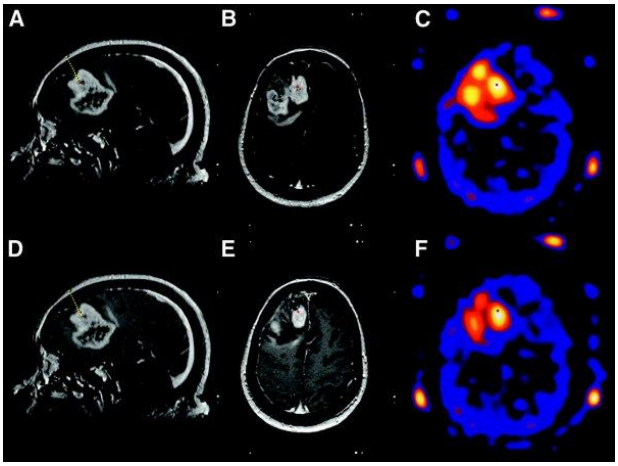

Figure1 Brain Tumor MRI image

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2. RELATED WORK

In brain tumor identification MRI scan images are most referred by many authors for detection of tumor. These MRI scan images are gray level images whose gray scale varies from 0 to 255.

Mohammad Havaei et al. paper presents Brain tumor
Segmentation using improved fuzzy c-means clustering (IFCM) for MRI images. This proposed method has been used to determine the similarity measurement. With this algorithm, during clustering, each pixel attracted towards its neighboring pixel, toward its own cluster. It's depending on pixel intensity or feature attraction and spatial position of neighborhood [1].

Marieke Anna de Ruiter et al. proposed algorithm which based on incorporating tissue probability maps for computation of point similarity measurement that improves accuracy. This similarity measures gave the best result in case of large initial misregistration [3].

Arthur H et al. paper presents an atlas based fuzzy connectedness segmentation technique for automatic segmentation of brain magnetic resonance imaging. Brain atlas can give important data by measuring the difference between abnormal and normal brain. This proposed method is a combination of atlas registration, FC segmentation, PABLIC correction and Re-FC segmentation together to get automatic brain MRI segmentation. Atlas registration concept is used to eliminate the overall position and scale differences between the atlas and MRI depending on four concepts like normalized mutual information as the similarity measure, similarity transform, power optimization and nearest neighbor interpolation [4] .

Elisee Ilunga-Mbuyamba et al. have been used Support Vector Machines (SVM) classifier with Immune algorithm (IA) for tumor detection of MRI images. In this paper morphological functions are used to remove speckles. In this paper, author concluded that the one class SVM has good performances in solving the nonlinearity problem [5].

Heba M et al. proposed a novel multiscale method for patient specific adaption of a general healthy brain
atlas to MR images of tumor patient. This proposed method for tumor growth modeling integrates discrete and continuous approach for simulation. They offered implicit segmentation of brain tissues. In this paper intensity normalization, edge- preserving smoothing and bias field correction had done between the atlas and the patient image [6].

D. Mantzavinos et al. proposed a new method for brain tumor detection is based on histogram. the histogram based thresholding method is used for segmentation of brain tumor . This proposed method is mainly based on the symmetrical structure of brain, pixel intensity of the image and binary image conversion. The author acquired MRI brain tumor images then subdivided into two equal halves around its central axis and the histogram of each part has been taken into consideration to calculate the threshold point . By considering these threshold point cropping of the tumor has done. This work is mainly based on symmetrical structure of the brain, pixel intensity of the image and binary image conversion [7].

Behnood Gholami et al. have been used Mass spectrometry (MS) and machine learning for assessment of different types of tumor. The MS imaging has a tool used for computer aided for evaluation of tumor tissues. The proposed system is based on statistical model to identify the tumor type associated with the multi-ion images of given sample. They have used principal component analysis to reduce the dimension of the data and eliminate correlation among the component. The algorithm has a capability of identifying matches to tumor type and also to reject samples if tumor type is unknown or having greater degree of uncertainty in the classification [8].

Meiyan Huang et al. suggested an algorithm for segmentation of Brain tumor is local independent projection based classification (LIPC) method .The LIPC implementation has been done by considering dictionary construction, locally linear representation and classification steps. A multiresolution framework proposed in this paper for improvement of robustness and reduces computational cost [9].

Dominik Sturm et al. suggested an algorithm for Brain tumor identification where they have used high resolution (HR) images with different contrast. These high contrast images mainly used to upsample the low contrast images

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The algorithm proposed in this paper is based on a patch based approach. A patch based approach measures the similarities in the pixel intensity and presenting the similarity map between one pixel
and all other pixels in the image. The author used Gaussian filter for getting the edge information in this paper [10] .
P.senthil et al. suggested different edge detection techniques for identification of edges of Brain tumor. MRI images of brain are used by author for edge detection of a tumor .These MRI images contains noise. The noise removal has done using using spatial noise filters. The enhancement of these images has done to reduce blurring effect and to get more clear edges. The enhancement has been done using laplacian filter. This filter highlight the discontinuities and edges of MRI images .The brain tumor detection has been done using watershed segmentation techniques along with the morphological operators to detect tumor from MRI images [11] .
P.Senthil,MRI scan brain tumor images are also referred by Anam et al. for Brain tumor detection. In this paper the author has used linear filter for removal of noise from these MRI scan tumor images. The enhancement has done using Gaussian filter. Gaussian filter gives finer details of the object. Then the segmentation has been done using thresholding technique. By using this thresholding technique the gray scale input image is converted into binary image. The watershed segmentation method to detect tumor from these MRI images. Then the morphological operators are used to separate out the tumor region from input scan images [12].
P.Senthil,et al. proposed an algorithm for detection and quantification of brain tumor images. They worked on an algorithm that detect brain tumor using symmetry analysis method. In this paper multidimensional filter has been used for removal of noise from grayscale MRI images. A threshoulding method used in paper to obtain global threshold that convert an intensity image into binary image. Image segmentation is done using Watershed segmentation technique. Morphological operations are used to remove small object from segmented image to detect tumor [13] .
P.Senthil et al. proposed computer based diagnosis algorithm for detection of tumor location from MRI images. This paper basically divided into two phases such as brain segmentation and tumor extraction. The brain segmentation has done using dual tree wavelet based watershed segmentation algorithm and the tumor region extraction done by using morphological operators [13].
From the survey we can say that lot of work had been done using Modern image mining or by using Computer software techniques for detection of Brain tumor. The next section includes an algorithm proposed for detection of Brain tumor location and its edge using Tad plane Volume rendering.

3. PROPOSED METHODOLOGY

Magnetic resonance imaging (MRI) scan images are mostly used by many authors for detection of a brain tumor. These images give details of brain anatomy.
For detection and identification of affected region is possible by using Modern image mining.

Figure 2 shows various steps that are followed to extract exact tumor location and edges of tumor from MRI of brain tumor:

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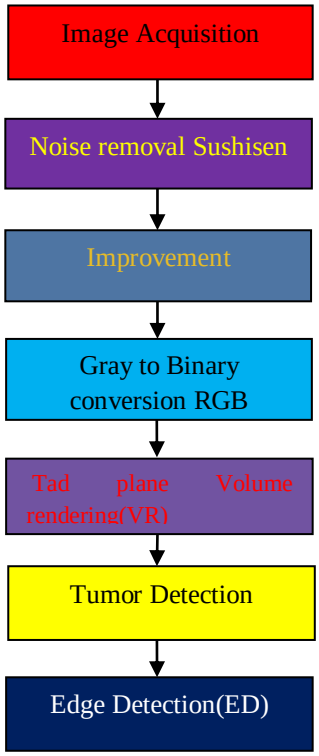

Figure 2 Tumor detection steps

A.IMPLEMENTATION

Brain tumor images are obtained from techniques like MRI, CT scan, X ray and Ultrasound. Here we have used MRI scanned images .These images are converted into gray scale images of size 256x256. These images contain some sort of noise.

i.Sushisen algorithms

Input: Image $\boldsymbol{I} = (\boldsymbol{R}, \boldsymbol{M})$ and timing constraint T_{spec}

Output: 256X256 budget management $\Delta E\boldsymbol{D}(\boldsymbol{VR})$

1. **begin**
2. Compute sushisen for each vertex $v \in \boldsymbol{VR}$, and find maximum sushisen $s_{mImage\ analysis}$
3. Initialize $\Delta E\boldsymbol{D}(\boldsymbol{VR}) = \mathbf{0}$
4. **while** $(s_m > 0)$
5. Construct a transitive Accuracy-sensitive find
6. $\boldsymbol{G}_i(\varepsilon)$ using $\boldsymbol{G}_i(\varepsilon)$-algorithm;

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7. Find maximum independent set $\boldsymbol{VR}_{MIS}$ of $\boldsymbol{G}_i(\varepsilon)$
8. Assign an incremental delay ε to each vertex in
9. $\boldsymbol{VR}_{MIS}$, i.e., $\Delta d(w) \leftarrow \Delta d(w) + \varepsilon$, $\forall w \in \boldsymbol{VR}_{MIS}$
10. Update slack distribution and s_m
11. **end**

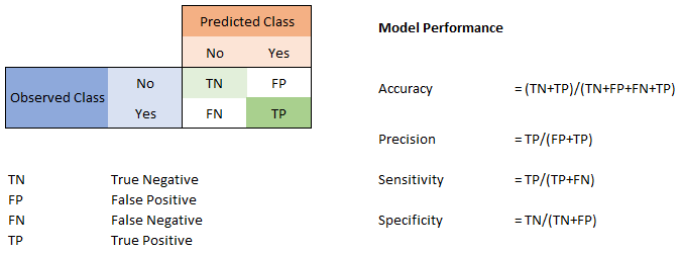

Figure 2.1. Tumor Over methods detection steps

B.EXPERIMENTAL

The experimental results of the proposed algorithm are shown in this section. The algorithm described in this paper is implemented in MATLAB, version 7.10. We used a personal computer with CPU 2.27 GHz, Core I5 processor and 4 GB of RAM under Windows 7 operating system.

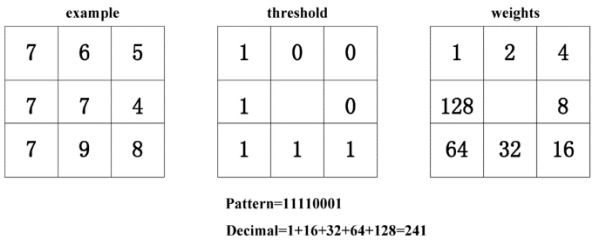

Figure 2.2 Tumor detection steps A

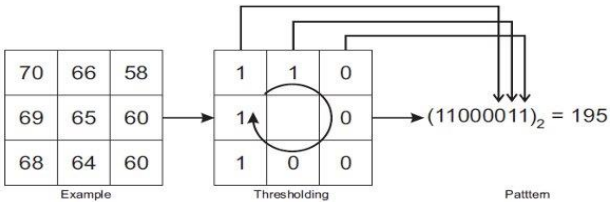

Figure 2.3 Tumor detection steps B

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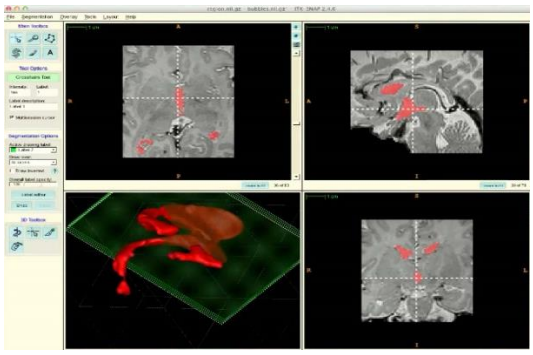

Figure 2.4 Tumor detection steps C

DISCUSSION

The noise in images can be remove using filter. There are different types of filters like geometrical filters, arithmetical filters, and non linear filters. After filtering MRI image, it may blur an image. The blurriness of an image can be removed by using image enhancing techniques. This is the next step after filtering; an image enhancement will give finer details, prominent edges of an object in an image and increases the sharpness of an image. Enhancement highlights the features of an image. Segmentation has done on this sharp image. Segmentation divides an image into separate region using different thresholding techniques.

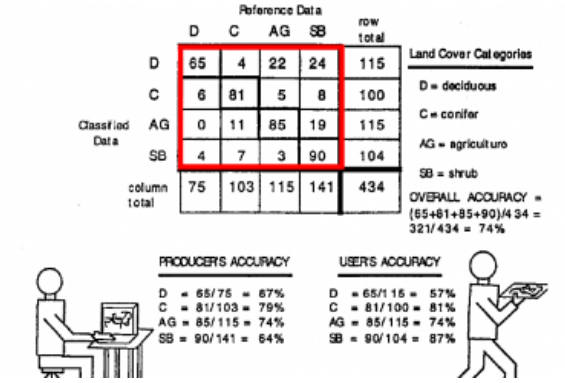

Figure 2.5 Tumor detection steps D

C.TEST

In brain tumor images, by using segmentation it is possible to separate out the tumor region from background. With the help of Tad plane Volume rendering techniques the MRI image has sliced into 8 separate planes and by selecting a proper plane, the mining has done to extract exact tumor location. After exaction of tumor location it's easy to find edges of tumor from MRI image.

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Student A

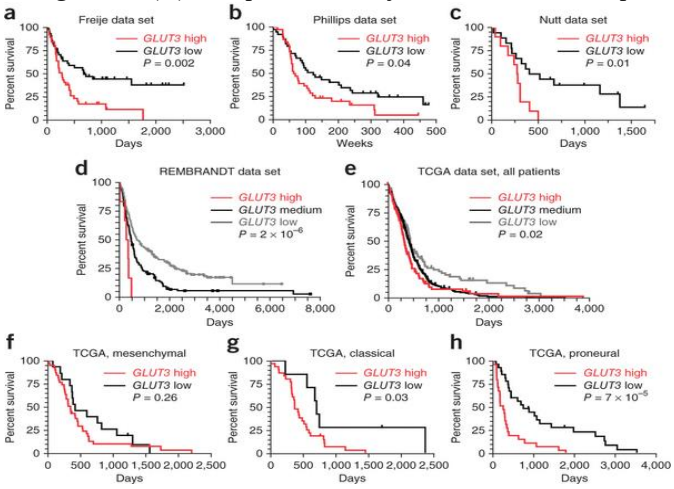
Case Name	% Score	Minimum Pass %	Must Pass	Weight	Weighted Score
Brain Tumor	65	60	Yes	2.0	130.00
Chest Pain	55	60	No	1.5	82.50
Cough & Cold	75	65	No	0.5	37.50

The score for the "Neurological" Form $= \frac{\text{Sum of Weighted Score}}{\text{Sum of the Weights}}$

$= \frac{(130.00 + 82.50 + 37.50)}{(2.0 + 1.5 + 0.5)}$

$= \frac{250.00}{4.0} = 62.5\%$

Figure 2.5 (A) Comparative Study Tumor detection steps



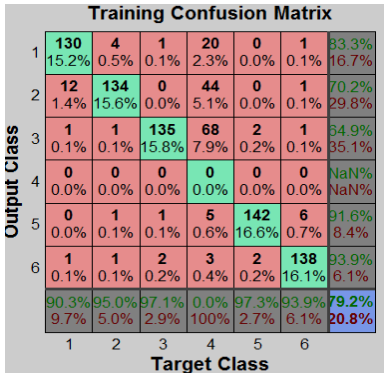


Figure 2.6 Tumor detection steps E

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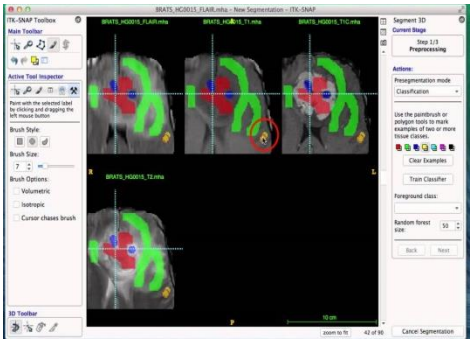
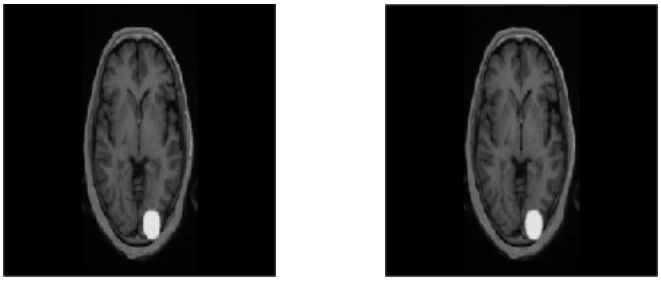


Figure 2.7 Tumor detection steps F

4. RESULT

Figure 3 shows the various stages that are followed, like filtering, Tad Volume rendering technique to get exact tumor location in MRI. In figure 4 , a and c are MRI of brain tumor whereas b and d are tumor regions detected by Tad plane Volume rendering technique.



a. MRI of brain b. Filtered image

c . Tumor location d. Edge of c

Figure 3. Steps followed to extract tumor location

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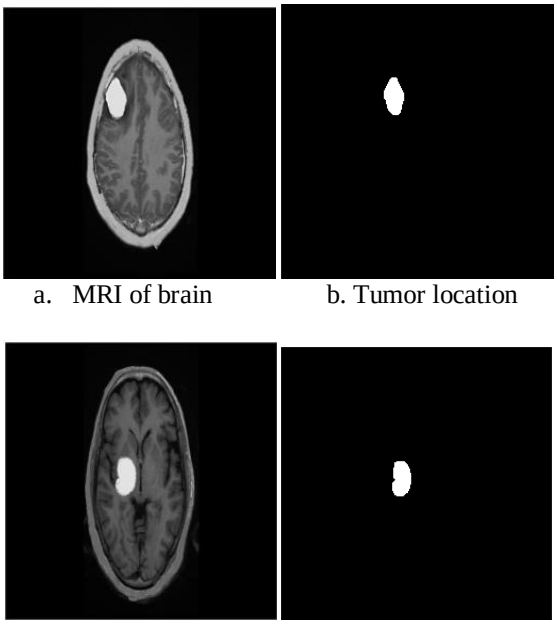

a. MRI of brain b. Tumor location

c. MRI of brain d. Tumor location

Figure 4. Tumor regions is extracted from the original brain MRI image

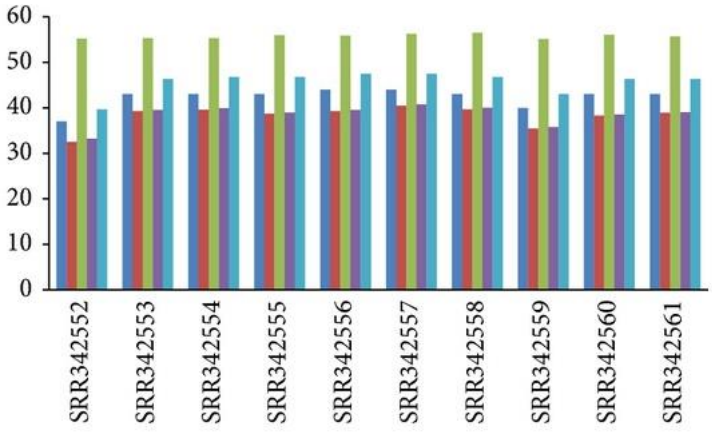

Figure 4.1 Tumor detection steps A

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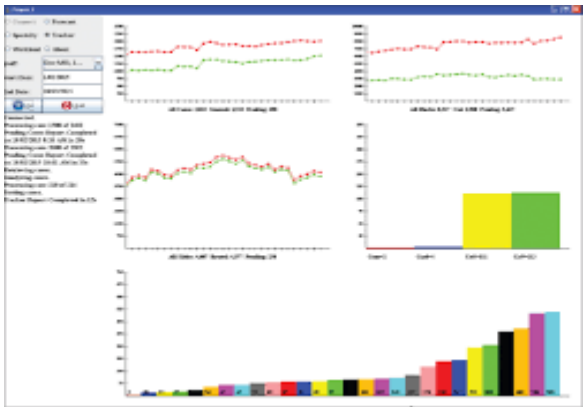

Figure 4.2 Tumor detection steps B

5. CONCLUSION

In this paper, the proposed algorithm is an approach for detection of tumor region from MRI. The MRI scan images have noise in them. So at the initial stage, it is essential to remove artifacts from these scan images and then enhancement them to get more details of MRI. This algorithm efficiently segments tumor from MRI of brain tumor. The proposed Tad plane Volume rendering technique is one of the segmentation technique which separate out the tumor region successfully with the help of this algorithm. From the results in previous section, it's observed that the proposed algorithm based on Tad plane Volume rendering gives much accurate and clear results for detection of tumor location and its edge from MRI images.

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