RESEARCH ARTICLE

LITERATURE SURVEY ON 3D BRAIN TUMOR SEGMENTATION IN MRI IMAGES

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ABSTRACT

Brain Tumor is an abnormal tissue found in Brain. Some techniques like MRI and CT generate 2D images of internal parts of the body. As two dimensional images never give the actual feel of how a tumor exactly looks like, 3D reconstruction of the tumor is necessary for diagnosis, surgical planning and biological research. Diversity and complexity of the tumors makes it very challenging to visualize tumor in MRI. 3D image reconstruction is one of the most attractive avenues in digital signal processing especially due to its application in biomedical imaging. In this paper work a presentation of an efficient and effective approach to 3D reconstruction was done. It involves the implementation of various steps like image classification, image segmentation ACO algorithm and finally mesh generation using marching cube algorithm and rendering to give realistic effects (Haithem Boussaid *et al.,* 2013).

Key words: Brain tumor, Magnetic Resonance Imaging (MRI), 3D Reconstruction, Meshing, Rendering ,segmentation

INTRODUCTION

Brain tumor is inherently serious and life-threatening because of its invasive and infiltrative character in the limited space of the intracranial cavity. Hence determining its pathology, volume and complexities is crucial for surgical planning and knowing the stage of cancer. Magnetic resonance imaging (MRI) is the commonly used imaging modality for non-invasive analysis of the brain tumor. MRI uses radio waves and magnetic fields to acquire a set of cross sectional images of the brain. That is anatomic details of the 3D tumor are presented as a set of 2D parallel cross sectional images. Representation of a 3D data in the form of 2D projected slices does result in loss of information and may lead to erroneous interpretation of results. Also, 2D images cannot accurately convey the complexities of human anatomy and hence interpretation of complex anatomy in 2D images requires special training. Although radiologists are trained to interpret these images, they often find difficulty in communicating their interpretations to a physician, who may have difficulty in imagining the3D anatomy. Hence, there is a need for 3D reconstruction of the tumor from a set of 2D parallel cross sectional images of the tumor. 3D visualization enables better understanding of the tumor, and enables measurements of its geometrical characteristics. The extracted information is helpful in staging of tumor, surgical planning, and biological research.

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Therefore, how to reconstruct a trustworthy surface from the sequential parallel 2D cross sections becomes a crucial issue in biomedical 3D visualization.

Literature Survey

In (Haithem Boussaid *et al.,* 2013).Haithem Boussaid, Iasonas Kokkinos, Nikos Paragios, Ecole the authors develop a method for the efficient automated segmentation of brain tumors by developing a rapid initialization method. Brain tumor segmentation is crucial for brain tumor resection planning, and a high-quality initialization may have a significant impact on segmentation quality. The main contribution of our work is an efficient method to initialize the segmentation by casting it as nonparametric density mode estimation, and developing a Branch and Bound-based method to efficiently find the mode (maximum) of the density function. Our technique is exact, has guaranteed convergence to the global optimum, and scales logarithmically in the volume dimensions by virtue of recursively subdividing the search space through Branch-and-Bound. Our method employs the Dual Tree data structure originally developed for nonparametric density estimation, and recently used for object detection with branch-and-bound. The author uses 'close the loop', and use the Dual Tree data structure for finding the mode of a density. This estimated mode provides our system with an initial tumor hypothesis which is then refined by graph-cuts to provide a sharper outline of the tumor area. It was demonstrated a 12-fold acceleration with respect to a standard mean-shift implementation, allowing us to accelerate tumor detection to a level that would facilitate high-quality brain tumor resection planning. In this paper, the

author presented a Branch-and-Bound based method for efficient mode estimation in KDE. This method was used for brain tumor detection and segmentation of 3D MR images. It was demonstrated that our method results in a12-fold speedup over standard Mean-Shift. Our approach is more robust than applying graph cut on the whole volume. The largest part of the computational time is taken by feature computation which can easily accelerated with graphic processing units. Future directions include evaluating and adapting the proposed approach to the 3D liver tumor tracking in radiation therapy where real time is crucial. In Purnita Majumder and Kshirsagar 2013 stated that while investigating it was found that the authors deals with the detection of tumor stage in brain MR images with efficient algorithm and 3D assessment of brain for tumor detection providing better result. Tumor is an abnormal growth of tissues reproducing themselves in any part of the body. There are different types of tumor having different Characteristics and treatment. A large number of people having brain tumors die due to inaccurate detection. Magnetic resonance imaging (MRI) is a diagnostic procedure that uses a combination of radio frequencies, large magnet, and a computer to generate detailed images of organs and structures within the body. MR image is examined visually by the physician for detection & diagnosis of brain tumor. However this method of detection consists of less accuracy while detecting the stage & size of tumor. This project uses a computer aided method for segmentation (detection) of brain tumor based on the combination of algorithms. This method segmentation of tumor tissue is done with accuracy and reproducibility than manual segmentation with less analysis time. Then the tumor is extracted from the MR image and its exact position, shape and stage is determined. Then 3D analysis of brain MRI with the help of 3D analyzer tool and graph generation for tumor growth rate of particular patients and tumor types will be done. The proposed system has mainly six modules: preprocessing, segmentation, Feature extraction, Stage detection, 3D assessment, and graph generation. In Pre-processing filtering is performed on the MR image. Advanced K-means and Fuzzy C-means algorithm are used in segmentation work. Thresholding is used for feature extraction. To recognize the tumor shape, position and stage of tumor in MRI image edge detection method is used. The proposed method consists of two algorithms. As shown the diagram below, the proposed system, is divided into the following 6 main phases: The flow for proposed system is shown in Fig 1.

The author concluded that among different types of tumors available they may be exist as malignant over the brain or mass in brain. To extract mass tumor from brain cells MRI K- means algorithm is enough. If there is any noise present in the MR image then it is removed before the K-means process. Input to the k-means is the noise free image and tumor will be extraction will be done from the MRI image. And then using modified Fuzzy C means segmentation is done for accurate tumor shape extraction of malignant tumor and in feature extraction thresholding of output is carried out. Finally calculation of tumor shape, position, and stage is done using specific formulae. After that the experimental results are compared with other algorithms graphs will be generated. The proposed method will give more accurate result. Also 3D analysis will be done through 3D slicer. In future this system can be implemented with some other algorithm which will give more accuracy and save more time.
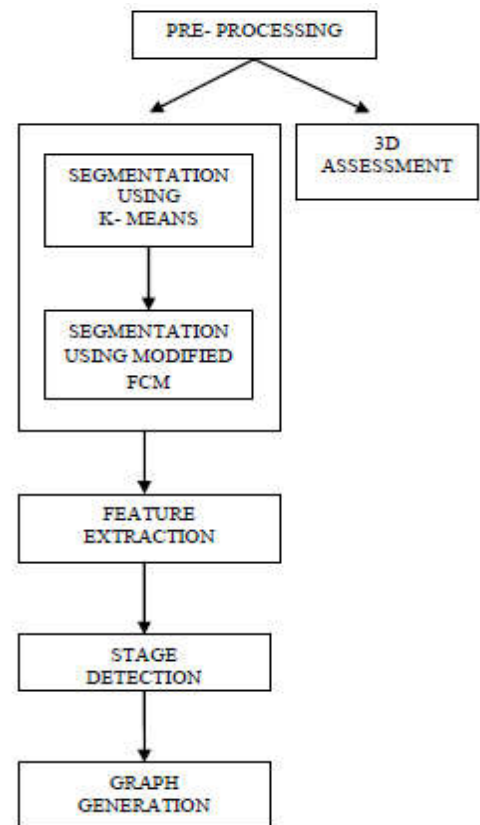

Fig. 1. Flow Diagram for Proposed System

In Manjula and Ramesha, 2013 the authors develop a number of useful algorithms developed for segmentation of medical image. Each method comes with its own set of features. Daily growth of medical data volume leads to raise human mistakes in their manual analysis and increase the requests to analyze automatically. Therefore applying some tools to collect, classify, and analyze the medical data automatically is necessary to decrease the human mistakes. The analysis and study of the brain is of great interest due to its potential for studying early growth patterns and morphologic changes in the tumour process. Segmentation of anatomical regions of the brain is the fundamental problem in medical image analysis. The author in this paper propose a brain tumor segmentation method has been developed and validated segmentation on 2D MRI Data. Also detected tumors are represented in 3-Dimensional (3D) view. 3D visualization of tumor yields actual shape and size of the tumors along with their positions. Finally, work was carried over to calculate the area of the tumor of single slice of MRI data set and then it was extended to calculate the volume of the tumor from multiple image MRI data sets. Experimental results for a single MRI slice have been reported. The carried out work mainly focuses on detecting tumor from brain MRI image slices using different image processing aspects. Segmentation is used to detect the tumor from the input MRI image slices. Also extending the work in order to find out the exact shape and size of the image, the detected tumor is reconstructed in 3-Dimensional (3D) view. The area and volume of the tumor has been calculated. In this Project work User friendly algorithm for processing the MRI image slices for their construction of Tumors was developed. The algorithm was tested and calibrated using real MRI data. In the application of the algorithm the real data was enhanced and the tumor was extracted from the images in a user friendly way. The 2D extracted tumor images were reconstructed into 3D volume tricdata and the volume of the tumor was also calculated.
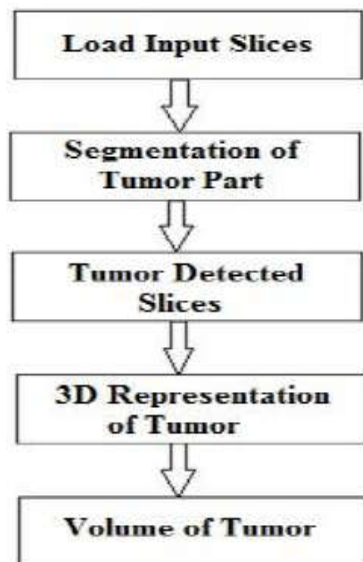
Fig. 2. Flowchart of the proposed work

In (Ali *et al.,* 2013) Kadom Abood Rabab Saadoon Abdoon stated that three-dimensional images of brain tumors are extracted from a series of MRIs of successive T1-weighted slices; by implementing K-Means clustering, Fuzzy C-Mean (FCM), and an enhancement method. The MRIs are pre-processed through bilateral filtering to reduce noise and retaining the edges between brain tissues. The K-Means is used to segment the image into five and six clusters, while the FCM is used to produce six clusters. Spatial enhancement technique is utilized to highlighting the band density of the region of interest (tumor). Morphological operations are used to extract the tumor object of each slice. The tumor contours are used to create 3D view of the tumor. The relative size of the tumor is measured after divestiture the skull tissue. The statistical measurements showed that the K-Means and FCM algorithms produced similar results when compared with the enhancement method. A comparison between the 3D extracting results of tumor regions obtained by implementing; Enhancement Method and clustering techniques (using K-Means and Fuzzy C-Means) is presented. The brain tumor regions of three successive MRI T1-weighted slices are used.. The segmented results are used to construct 3D image for the tumor regions. The 3D of the tumors has been inserted in 3D contours of the head. The relative size of the tumor has been measured with respect to brain size. Moreover, the geometric properties of the tumor region have been calculated. The calculated properties showed that the results of the K-Means and FCM are much closer to each other than the Enhancement method. However, the results proven that these techniques can be adequately used to detect and extract the brain tumor in MRI images, which can be integrated with the results of other studies to help doctors in surgery, diagnosis, treatment planning and therapeutically monitoring. The authors would like to recall that the results have been presented to specialist physicians in the diagnosis of brain tumors and surgeons and they indicated their consent and impressed with the results. In Megha Arakeri and Ram Mohana Reddy 2013 National Three dimensional (3D) reconstruction of the tumor from medical images is an important operation in the medical field as it helps the radiologist in the diagnosis, surgical planning and biological research. Thus in this paper, we propose an effective and efficient approach to 3D reconstruction of brain tumor and estimation of its volume from a set of two dimensional (2D) cross sectional magnetic resonance (MR) images of the brain.

In the first step, MR images are preprocessed to improve the quality of the image. Next, abnormal slices are identified based on histogram analysis and tumor on those slices is segmented using modified fuzzy c-means (MFCM) clustering algorithm. Next, the proposed enhanced shape based interpolation technique is applied to estimate the missing slices accurately and efficiently. Then, the surface mesh of the tumor is reconstructed by applying the marching cubes (MC) algorithm on a set of abnormal slices. The large number of triangles generated by the MC algorithm was reduced by our proposed mesh simplification algorithm to accelerate the rendering phase. Finally, rendering was performed by applying Phong lighting and shading model on the reconstructed mesh to add realism to the 3D model of the tumor. The volume of the tumor was also computed to assist the radiologist in estimating the stage of the cancer. All experiments were carried out on MR image datasets of brain tumor patients and satisfactory results were achieved. Thus, our proposed method can be incorporated into the computer aided diagnosis (CAD) system to assist the radiologist in finding the tumor location, volume and 3D information. Proposed Methodology The main task of 3D reconstruction of the tumor from a set of 2D parallel cross sectional images is divided into several subtasks as shown in Fig 3.
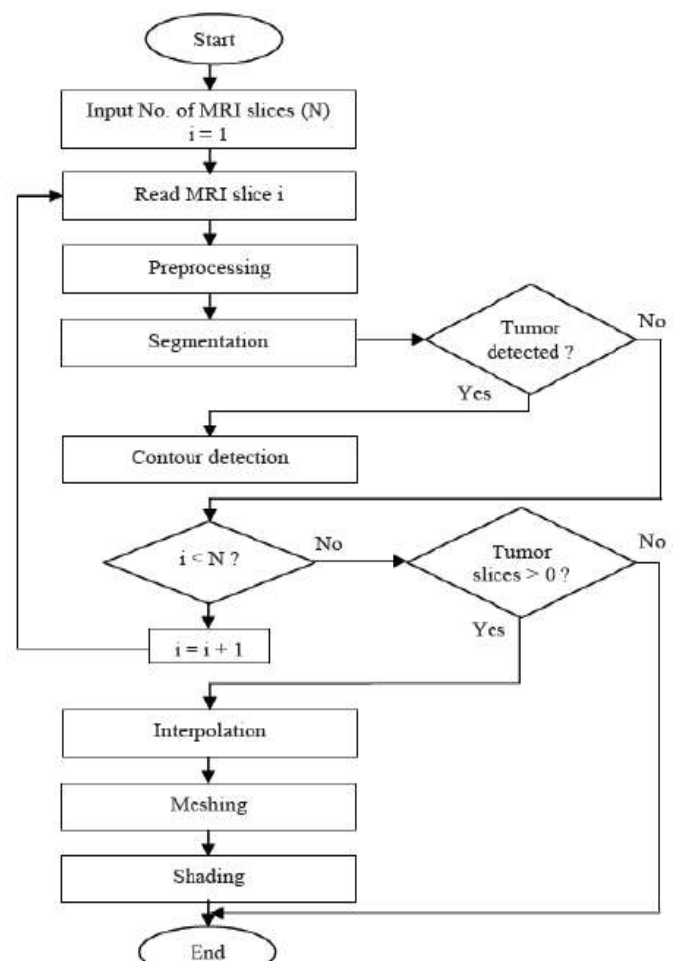

Fig. 3. Flowchart of the Proposed 3D Tumor Reconstruction

The aim of this paper was to develop a 3D reconstruction and quantification approach for assisting the physician in surgical planning and volume computation of the tumor. The 3D model of the brain tumor was reconstructed from a given set of 2D slices of the brain by developing methods for segmentation, inter-slice interpolation, mesh generation and simplification.

Slices containing tumor were extracted from a given set of slices of the brain and the tumor was segmented with the proposed segmentation technique. The centroid alignment technique in the proposed enhanced shape based interpolation helped in accurately estimating the missing slices by handling the shifts in the cross sections and the inclusion of the chamfer distance transform improved the efficiency of shape based interpolation method. Rendering phase was accelerated by simplifying the mesh with the proposed mesh simplification algorithm. The reconstructed tumor was also quantified by measuring its volume. The experimental results showed that our proposed 3D reconstruction approach can generate an accurate 3D model in less amount of time and thus can assist the radiologist in the diagnosis, identifying the stage of the tumor and treatment planning. In Chethankumar and Anithakumari 2014, Some techniques like MRI and CT generate 2D images of internal parts of the body. As two dimensional images never give the actual feel of how a tumor exactly looks like, 3D reconstruction of the tumor is necessary for diagnosis, surgical planning and biological research. Diversity and complexity of the tumors makes it very challenging to visualize tumor in MRI. 3D image reconstruction is one of the most attractive avenues in digital signal processing especially due to its application in biomedical imaging. Work presents an efficient and effective approach to 3D reconstruction. It involves implementation of various steps like image pre-processing, image segmentation by FCM, Mesh generation by marching cubes algorithm and finally rendering to add realistic effects. Design and implementation.
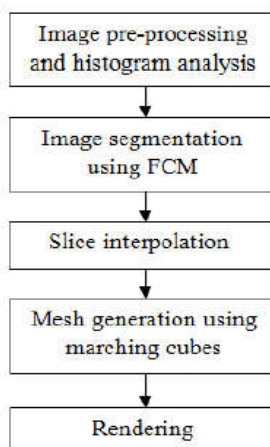

Fig. 4. Flowchart for 3D reconstruction

The 3D model of the brain tumor was reconstructed from 2D slices of brain by developing methods for segmentation, inter-slice interpolation and mesh generation. The tumor was segmented by using FCM technique. The skull part was removed by masking .The slices with tumors were stacked. By using Marching cubes Meshing algorithm the tumor was reconstructed. The experimental results show that our proposed 3D reconstruction approach can generate an accurate 3D model in less time. Thus it can assist the radiologist in diagnosis, identifying the tumor stage and treatment planning. 3D graphics gives a better perspective on shape and size, thus making more efficient diagnosis possible. Since the FCM segmentation is non deterministic algorithm, an algorithm can be proposed to minimize the time for execution. Large numbers of triangles are generated by the marching cubes algorithm; hence an algorithm is to be designed to minimize the triangles so that the reconstruction time speeds up.

In Sushma Laxman Wakchaure and Anil Khandekar 2015, authors stated that A tumor also known as neoplasm is a growth in the abnormal tissue which can be differentiated from the surrounding tissue by its structure. A tumor may lead to cancer, which is a major leading cause of death and responsible for around 13% of all deaths world-wide. Cancer incidence rate is growing at an alarming rate in the world. Great knowledge and experience on radiology are required for accurate tumor detection in medical imaging. Automation of tumor detection is required because there might be a shortage of skilled radiologists at a time of great need. It was proposed a Visualization of 3d View of Detected Brain Tumor and Calculation of its Volume that can detect and localize brain tumor in magnetic resonance imaging. The proposed brain tumor detection and localization framework comprises five steps: image acquisition, pre-processing, edge detection, modified histogram clustering and morphological operations. It also include tumor detection with comparisons and finally 3D model is obtain of tumor detected portion with its volume. Proposed method developed a tumor detection method using three parameters; edge (E), gray (G), and threshold value (T) values. The method proposed here studied the EGT parameters in a supervised block of input images. These feature blocks were compared with standardized parameters (derived from normal template block) to detect abnormal occurrences, e.g. image block which contain lesions or tumor cells. The proposed method shows more precision among the others. Processing time is less also proposed system implement more than one edge detection system i.e. sobel edge detection and canny edge detection method. Result also compared of implemented both methods. This will help the physicians in analyzing the brain tumors accurately and efficiently. It is used to segment the brain tumor from 2D images and then converting it into 3D for further model analysis and volume calculation.

The first aim of this work is to develop a framework for a robust and accurate segmentation of a large class of brain tumors in MR images. Most existing methods are region-based. They have several advantages, but line and edge information in computer vision systems are also important. The proposed method tries to combine region and edge information, thus taking advantage of both approaches while cancelling their drawbacks. 3D contrast enhanced T1-weighted and FLAIR images are the inputs to perform an automatic segmentation of the solid part of tumor and the potential associated edema and necrosis. first a segmentation was done the brain to remove non-brain data. However, in pathological cases, standard segmentation methods fail, in particular when the tumor is located very close to the brain surface. Therefore it was propose an improved segmentation method, relying on the approximate symmetry plane. Then a developed two new and original methods to detect and initially segment brain tumors. The first one is a fuzzy classification method which combines membership, typicality and neighborhood information. The second one relies on a symmetry-based histogram analysis. The approximate sagittal symmetry plane is first computed, and the tumor is then extracted by comparing the histograms of the two cerebral hemispheres. To refine the initial segmentation, which is not accurate enough, edge information was used. A deformable model constrained by spatial relations is applied for this purpose. Volume of severe block of image is also calculated. Proposed Methodology The algorithm has two stages, first is preprocessing of given MRI Image and second is Tumor Detection and 3D visualization

after calculating volume of detected portion of tumor. Then perform morphological operations on them. Algorithm steps are as follows:-

- Give MRI images as input (this is images of tumor).
- Convert this image into gray scale.
- Compute threshold segmentation.
- Calculate the boundaries using edge detection sobel algorithm and Canny Edge detection is used. Result also compared.
- Tumor Detection.
- Tumor Comparisons
- 2D visualization of Tumor
- 3D visualization of tumor and volume calculation.
- Finally will get a final output a tumor region.

In this paper, the author introduced a conceptually simple classification method using multi-parameter features on supervised block to computationally classify brain images. Our conclusion is that the proposed method is effectively capable of identifying tumor areas in T2-weighted medical brain images taken under different clinical circumstances and technical conditions, which were able to show high deviations that clearly indicated abnormalities in areas with brain disease. The response time for processing system is 176 milliseconds for each image analysis. Currently working towards improving the brain model to include more cases. This method gives 99.9% efficiency in segmenting out tumor. After which the 3D volume representation of the tumor can be obtained within few seconds as mentioned above. This will save a lot of time of the surgeons and radiologist providing a much modern technique for brain tumor surgery. As the future work, the validity of procedure can be observed by applying to more cases of same type as well as on other types of tumor. In order to match the results of volume with the original data its required to have such cases in which the whole tumor is sent for biopsy. The 3D analysis and volume calculations can be done by any other software such as SPM and MATLAB. The results can be compared. This will allow error calculations to be done. By 3D modeling of different types of tumors the similarities and differences can be seen between them regarding their shapes and structures which will be helpful for the physicians. This can be done with in depth study of different cases of tumor which in turn help the medical professionals in classifying the tumors types on the basis of their volume. In Sakthi Bharathi and Manimegalai 2015, In this paper two approaches was represented to reconstruct 3D shapes of brain tumours from MRI images. The firstapproach is reconstruction of 3D images from set of 2D segmented slices of MRI brain by using thresholding andmorphological operations; contour plot and patches. The second approach is a better one where a tumourconstructed by using same segmentation process and altering the 3D reconstruction algorithm that uses sobel operator, boundaryextraction, Delaunay triangulation and alpha shapes. The volume to area ratio of the tumour and the distance betweenpoints on head and the points on tumour is estimated. Delaunay Triangulation affords distinct advantages, such as: its ability to describe the surface at different levels of resolution, efficiency in storing data, ease of storage and manipulation, easy integration with raster databases, smoother, more natural appearance of derived terrain features. However it was encounter a few disadvantages such as: in many cases it requires visual inspection and manual control of the network, various grid sizes cannot be used to reflect areas of different

complexity of relief. The objective of this work is to implement an algorithm which gives better 3D reconstruction of braintumours of MRI images. The main task of 3Dreconstruction of the tumour from a set of 2D parallel cross sectional images is divided into several subtasks as shown in Fig 5. The main techniques followed in thiswork are:

- Segmentation of the desired object from MRI scans with Sobel Operator and morphological operations.
- Reconstruction of the 3-D model with Delaunay'striangulation
- Visualizing the resulting model using triangular Surfacea novel method for 3D reconstruction was proposed.

The method mainly includes Delaunay triangulation alpha shapes and patches; the first approach used is the 3d reconstruction from its 2dcontours using a sequence of 2d contours, detected by Segmentation process. The second approach improves the segmentation quality and the 3D reconstruction of the tumor by determining the volume area ratio and distance between points on head and the points on tumour. This method will help to find the exact location of the tumour and the size of the tumour which will be of help to the oncologist to make objective decisions about diagnostics and treatment of the condition.
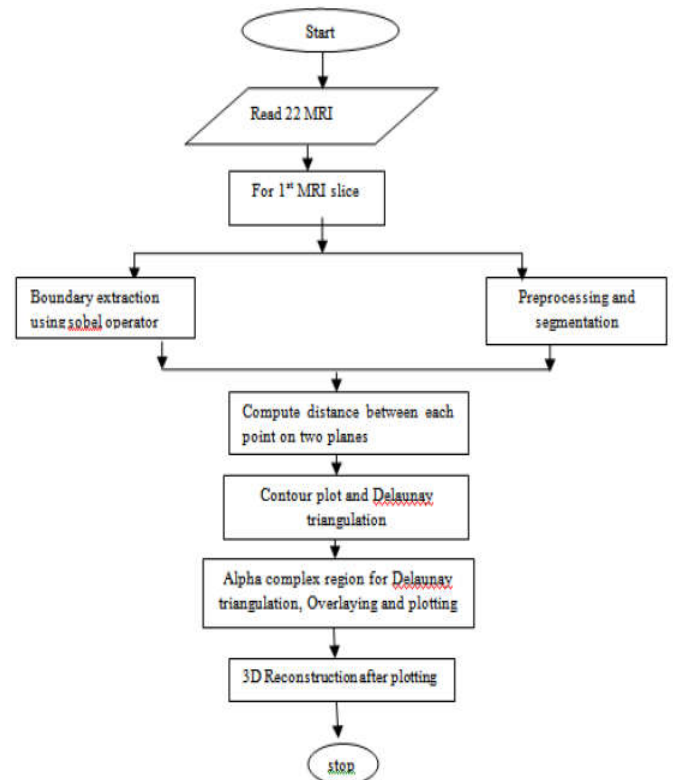

Fig. 5. System flowchart

In Sushma Laxman Wakchaure, Anil Khandekar 2015, Visualization of 3D view of detected brain tumor and calculation of its volume, a tumor also known as neoplasm is a growth in the abnormal tissue which can be differentiated from the surrounding tissue by its structure. A tumor may lead to cancer, which is a major leading cause of death and responsible for around 13% of all deaths world-wide. Cancer incidence rate is growing at an alarming rate in the world. Great knowledge and experience on radiology are required for accurate tumor detection in medical imaging. Automation of

tumor detection is required because there might be a shortage of skilled radiologists at a time of great need. Authors propose a Visualization of 3d View of Detected Brain Tumor and Calculation of its Volume that can detect and localize brain tumor in magnetic resonance imaging. The author proposed a brain tumor detection and localization framework comprises five steps: image acquisition, pre-processing, edge detection, modified histogram clustering and morphological operations. It also include tumor detection with comparisons and finally 3D model is obtain of tumor detected portion with its volume. Proposed method developed a tumor detection method using three parameters; edge (E), gray (G), and threshold value (T) values. The method proposed here studied the EGT parameters in a supervised block of input images. These feature blocks were compared with standardized parameters (derived from normal template block) to detect abnormal occurrences, e.g. image block which contain lesions or tumor cells. The proposed method shows more precision among the others. Processing time is less also proposed system implement more than one edge detection system i.e. sobel edge detection and canny edge detection method. Result also compared of implemented both methods. This will help the physicians in analyzing the brain tumors accurately and efficiently. It is used to segment the brain tumor from 2D images and then converting it into 3D for further model analysis and volume calculation.In this paper an introductionto the conceptually simple classification method using multi-parameter features on supervised block to computationally classify brain images. Our conclusion is that the proposed method is effectively capable of identifying tumor areas in T2-weighted medical brain images taken under different clinical circumstances and technical conditions, which were able to show high deviations that clearly indicated abnormalities in areas with brain disease. The response time for processing system is 176 milliseconds for each image analysis. Currently the authors are working towards improving the brain model to include more cases. This method gives 99.9% efficiency in segmenting out tumor. After which the 3D volume representation of the tumor can be obtained within few seconds as mentioned above. This will save a lot of time of the surgeons and radiologist providing a much modern technique for brain tumor surgery. As the future work, the validity of procedure can be observed by applying to more cases of same type as well as on other types of tumor. In order to match the results of volume with the original data that is required to have such cases in which the whole tumor is sent for biopsy. The 3D analysis and volume calculations can be done by any other software such as SPM and MATLAB. The results can be compared. This will allow error calculations to be done. By 3D modeling of different types of tumors it can be seen that the similarities and differences between them regarding their shapes and structures which will be helpful for the physicians. This can be done with in depth study of different cases of tumor which in turn help the medical professionals in classifying the tumors types on the basis of their volume.

In Sayali Lopes 2015, It always takes a skilled neurologist to detect a tumor in the MRI scans, which the numerologist does with the naked eye. Doctors have had only 2D cross sectional images for viewing the tumor in the MRI scans. This research presents a method for automatic tumor detection with an added feature of reconstructing its 3D image. The research involves implementation of various steps of detecting and extracting the tumor from the 2D slices of MRI brain images by Seeded region growing technique along with automatic seed selection

and designing software for reconstructing 3D image from a set of 2D tumor images. The seeded region growing method is very attractive method for semantic image segmentation which involves high level knowledge of image components during the seed selection procedure. The volume of the tumor is also estimated based on the computation of these images to assist the radiologist. This paper proposes a method for detection and 3D-reconstruction of brain tumor. The following steps describe the overall architecture of the processing of the system. First it starts with the loading of the MRI brain image, which is considered as an input image. The preprocessing of this input image takes place i.e. the enhancement of the image. In the segmentation stage, first the tumor pixels are identified then extracted. The tumor volume is calculated and the 3D volume data is displayed. The flow of the proposed systems is given in Fig. 1. The steps involved are explained below.
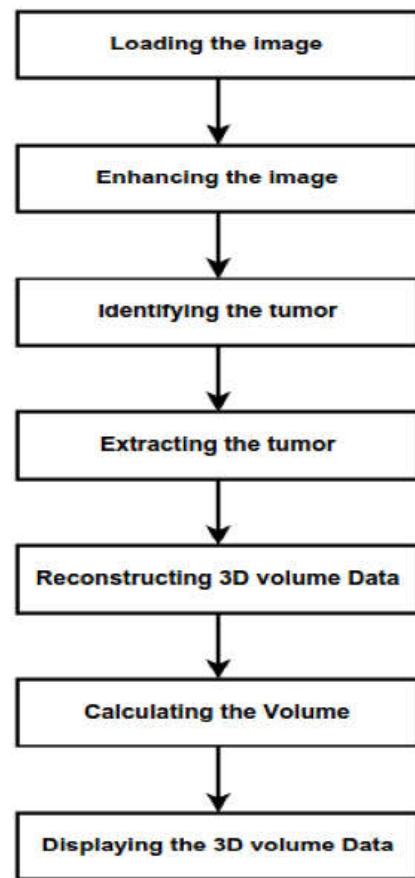

Fig 6: Flowchart of the proposed approach

Detection brain tumor in MRI in a fast, accurate, and reproducible way is a challenging problem. Automatic image segmentation has become very important aspect for realizing content based image description. Seeded region growing algorithm is robust, rapid and effective as compared other segmentation algorithm. In this paper a description of the effective approach for detection and 3D reconstruction of brain tumor using the seeded region growing algorithm using automatic seed selection along with volume computation of the tumor for assisting the physician in surgical planning. It is very difficult to classify a tumor as benign or malignant. There are a number of pathological features which contribute in determination of the tumor whether it is benign or malignant. This will be the topic for future research. Further. In Brain tumor pathology is one of the most common mortality issues considered as an essentialpriority for health care societies. Accurate diagnosis of the type of disorder is crucial to makea

plan for remedy that can minimize the deadly results. The main purpose of segmentation and detection is to make distinction between different regions of the brain. Besides accuracy, these techniques should be implemented quickly. In this paper an automatic method for brain tumor detection in 3D images has been proposed. In the first step, the bias field correction and histogram matching are used for preprocessing of the images. In the next step, the region of interest is identified and separated from the background of the Flair image. Local binary pattern in three orthogonal planes (LBP-TOP) and histogram of orientation gradients (HOG-TOP) are used as the learning features. Since 3D images are used in this research the authors uses the idea of in local binary pattern in three orthogonal planes in order to extend histogram orientation gradients for 3D images. The random forest is then used to segment tumorous regions. An evaluation to the performance of the algorithm on glioma images from BRATS 2013 was done. Our experimental results and analyses indicate that our proposed framework is superior in detecting brain tumors in comparison with other techniques.

In this paper authors proposed a framework to segment tumorous MRI images. In the first step bias field correction is used to increase the contrast of the input image. Then histogram matching is used. In the second step, in order to reduce the time and space complexity especially in the feature extraction phase of the algorithm, the multi-level Otsu thresholding algorithm is used. Given to the large number of data in 3D imaging, using multi-level Otsu algorithm reduces the volume of the data. These images are imbalanced; applying this clustering algorithm selects more balanced distribution of data for training. The third step, the feature extraction step, the local binary patterns (LBP-TOP) in three orthogonal planes and extended histogram of orientation gradients for 3D images (HOG-TOP) are used. The advantage of these features besides their simplicity is that they have a great discrimination capability for tissue images. Finally, the random forest, which has a high accuracy in segmentation and can function perfectly with large inputs, is used as a classifier to distinguish tumorous regions. Our experimental evaluations indicate significantly better improvements in segmenting tumor images and reduction in time complexity. In Saumya Gupta, Monika Agrawal, Sanjay Kumar Sharma 2016, these authorsstate that brain is that the anterior most a part of the central nervous system. Tumor is caused because of formation of additional cells in brain as a result of new cells build up whereas existences of older or broken cells for an unknown reason. Today's recent medical imaging analysis faces the challenge of detective work tumor through magnetic resonance pictures (MRI). Broadly, to provide pictures of sentimental tissue of body, MRI pictures are used by specialists. For tumor detection, image segmentation is needed. Physical segmentation of medical image by the radiotherapist may be a monotonous and prolonged method. Imaging may be an extremely developed medical imaging methodology providing made info concerning the person soft-tissue structure. There are varied tumor recognition and section strategies to find and segment a tumor from imaging pictures. A range of algorithms were developed for segmentation of magnetic resonance imaging images by exploitation completely different tools and methods. Instead this paper presents a comprehensive review of the ways and techniques accustomed find tumor through imaging image. The author analyzed a various methodologies of brain tumor detection and segmentation. This analysis was conducted to observe brain tumor using medical imaging

techniques. The main technique used was segmentation, which is done using a methodology based on threshold segmentation, watershed segmentation and morphological operators. The projected segmentation methodology was experimented with MRI scanned images of human brains: thus locating tumor in the images. Samples of human brains were taken, scanned using MRI method and then were processed through segmentation strategies thus giving efficient end results. Various methodologies of brain tumor detection and segmentation was analyzed. This analysis was conducted to observe brain tumor using medical imaging techniques. The main technique used was segmentation, which is done using a methodology based on threshold segmentation, watershed segmentation and morphological operators. The projected segmentation methodology was experimented with MRI scanned images of human brains: thus locating tumor in the images. Samples of human brains were taken, scanned using MRI method and then were processed through segmentation strategies thus giving efficient end results. In Chandrasekar *et al.,* 2017 the author state that a human body consists of a complex 3D structure. Conversion of 3D structures into 2D leads to a loss of information and may result in incorrect disease diagnosis. This issue has grasped the attention of researchers involved in 3D modeling. MRI scans consist of a large number of 2D slices, which makes 3D reconstruction a complex and time-consuming task. It was proposed an efficient algorithm that uses limited MRI slices to reconstruct a 3D image on the basis of matching criteria, which aids in the selection of most appropriate slices, which therefore significantly reduces computational complexity and increases accuracy. The methodology involves the acquisition of a brain MRI, pre-processing, OTSU's segmentation for the identification of suspicious areas, and rule-based classification to extract a tumor area. For appropriate slice selection, Rapid Mode image matching is utilized, 3D modeling is performed using a cubic reconstruction scheme. Proposed Work: An algorithm is presented in this paper in order to circumvent the limitation of existing techniques and significantly improve the accuracy rate of 3D reconstruction and volume estimation of brain tumors. In medical imaging, accuracy is an important perimeter that cannot be neglected. To reduce the computational cost and boost the accuracy rate, the following steps are applied in the proposed algorithm, which is briefly described in this section. The block diagram of proposed work is shown in Fig 7.
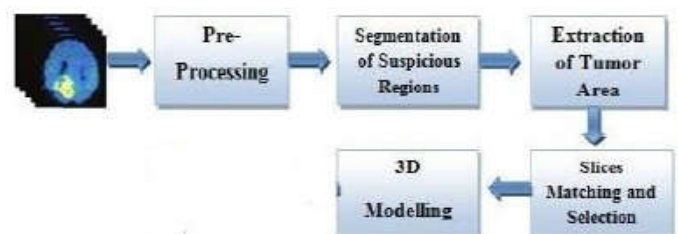
Fig. 7. Block diagram of 3D segmentation and reconstruction an efficient 3D brain tumor segmentation and reconstruction

Approach has been presented that utilizes slice matching to cut down on using a large number of slices. This work consists of five major steps: MRI brain slices are enhanced, segmented and tumor area is extracted, slices are selected using image matching algorithm, 3D reconstruction/modeling is done, and finally volume estimation is achieved. The main aim of the proposed scheme is to design a system that reduces

computational time and can create 3D model accurately. The proposed system is evaluated using MRI brain slices of 21 patients and achieved 96.6% accuracy. Improvement of the accuracy rate is a goal for the future. Patients with small brain tumors have less accuracy rate in tumor volume estimation when compared to patients with large tumors, which can be reduced further to accurately estimate the volume of early-stage tumors. The performance can also be improved by further reducing the complexity of the 3D modeling algorithm by reducing the number of slices without losing information. In Fathima Zahira and Mohamed Sathik 2018, Digital Image processing is applied under the area of medicine so as to distinguish the ailments in the body of humans. The three dimensional reconstruction (3D) of tumor from the medicinal images is a significant procedure in the area of medicine while it assists the physicians in identification, surgical planning and biological investigation. This article includes two phases namely,

- Classification and
- 3D reconstruction.

Originally the input image is obtained from the MRI database which then undergoes skull stripping is a pre-processing phase for identifying the brain tumor that purges the redundant borough from the image. In the classification phase, the skull Stripped images undergoes segmentation by means of the watershed algorithm so as to identify the segmented tumor. Then from the segmented image the attributes such as shape, intensity and texture are extorted. Subsequently the attributes are lessened via the Principle Component Analysis (PCA). Depending upon the condensed attributes, the probabilistic neural network classifier categorizes the normal and the abnormal (tumor) images. The next phase is the 3D reconstruction phase, it was intended the depth assessment for the skull stripped image by means of the guided filter. When the depth is attained, the visual relic of the created left view and right view images yields the ultimate 3D reconstruction outcomes. In our intended technique two phases namely were completed,

- Classification, and
- Reconstruction.

In the initial phase the Probabilistic neural network (PNN) classifier is employed for extorting the attributes. The comparative psychiatry of our intended technique is related with that of the several conventional techniques such as ANFIS and NN. The comparison outcome reveals that our intended PNN classifier approach yields better accuracy, sensitivity and specificity values than the conventional approaches. In the next phase of 3D reconstruction, the skull stripped is reconstructed depending upon the assessment of depth map by means of guided filter. By means of the depth map, left view and right view images are produced and lastly the stereoscopic images were engendered to afford a sense of depth to the viewers by means of anaglyph glasses. Moreover, the separation and loss relics of the synthesized outcomes are successfully prohibited with less computation intricacy.

Conclusion

This paper was prepared to discuss the literature review of 3D tumor Detection in MRI and the segmentation methods that is used in each paper, fourteen scientific papers was included from different scientific magazines that was issued from 2011 up to 2018, nonparametric density estimation on 1st page, thresholding in 2nd page, K-means and Fuzzy C-means algorithm in 3rd, 4th bilateral filtering to reduce noise and retaining the edges between brain tissues. The K-Means is used to segment the image into five and six clusters, while the FCM is used to produce six clusters. In the 5th paper segmented using modified fuzzy c-means (MFCM) clustering algorithm was used while in the 6th paper the author uses the edge detection and thresholding method, in the 6th the author uses the sobel filter for the segmentation, 7th the author reconstruct the 3D MRI image after segmentation for each slice. In 8th paper the Delaunay Triangulation affords distinct advantages, such as: its ability to describe the surface at different levels of resolution, efficiency in storing data, ease of storage and manipulation, easy integration with raster databases, smoother, more natural appearance of derived terrain features, 9th sobel edge detection and canny edge detection method was used, while 10th enhancement of segmentation process, in 11th the uses of the local binary pattern in three orthogonal planes in order to extend histogram orientation gradients for 3D images, in 12th Different Brain Tumor Detection and Segmentation Techniques in MRI and other Medical Images a various experiments was done to compare segmentation methods and compare between the sobl and cany filters for the segmentation process. In 13th is used to automatically perform clustering-based image thresholding, 14th watershed algorithm brain tumor segmentation.

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