[InnoSpace-2017:Special Edition]

Volume 4,Issue 1, January 2017, pp. 26-29 ISSN (O): 2349-7084

International Journal of Computer Engineering In Research Trends

Available online at: www.ijcert.org

New Method for Automatic Detection of Brain Tumor in Multimodal Brain Magnetic Resonance Images

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Abstract:-Brain tumor is a one of the severe life altering disease and analysis of brain imaging is a most important task of visualizing the brain inner anatomical structures, analyzing brain tumor and surgical planning. Magnetic Resonance Imaging is used to diagnose a variety of diseases in the brain and it is found to be much superior to other techniques especially for brain tissues. The main advantage is that the soft tissue differentiation is extremely high for MRI. Image processing plays vital role in medical image analysis and Image segmentation is a most conman technique for analysis of MR imaging in many clinical applications. The parallel segmentation methods and techniques are expressed for the automatic detection of tumor in multimodal brain MR Image by existing state-of-art methods. However the specific results are not being projected and established in the similar researches. Hence, this proposed work tackles about automatic segmentation and detection of tumor in multimodal brain MR images. The main aim of the proposed work to achieve high segmentation accuracy and detection of tumor in the multimodal brain MR images and it was demonstrated in multimodal brain MR Images, viz. FLAIR MRI, T1 MRI, MRI and T2 MRI. The relative performance of the Proposed Method is demonstrated over existing methods using real brain MRI and open brain MRI data sets.

Keywords: Brain Tumor, Watershed Method, FCMC method, Proposed Method, Bilateral Filter, Brain MR Image.

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1. Introduction

With the substantial advance in the brain MR imaging technique have exposed the broad possibilities of brain anatomy analysis based on multimodal Brain MR Images. The multimodal Brain MR Images presents the noninvasive broad visualization of internal anatomical understanding of the brain. In order to improve the accuracy for detection of tumor in multimodal Brain MR Images, the imaging techniques have extended the quality of the Brain MR images. Hence the exploration of this complex and high quality Brain MR Images became the major tedious task for the technicians [1]. Moreover, due to the human intervention the investigations are bound to be erroneous. Also,these manual analyses are a lot of time-consuming and restricted in discovering of tumor in multimodal Brain MR Images as compared with the computerized methods [1].

The method typically used for analysis of MR images is segmentation based imaging in clinical analysis. Image segmentation is usually used for measuring and visualizing the brain's anatomical structures, for analyzing brain changes, for delineating pathological regions, and for surgical planning and image-guided interventions. The limitations identified from the study exhibits various segmentation techniques are restricted in generating high accuracy and mostly focused on brain tumor detection. The recent researches also fail to achieve the supreme accuracy [2]. Multimodal MR Image is mainly used for analysis and detection of brain disorder. In multimodal brain MR images have a variety of series such as T1 MR Image, T2 MR Image and FLAIR MR Image. This work presents the detection of tumor in multimodal Brain MR Image. The rest of the paper is organized as follows, in Section 2 this paper discuss about the Existing techniques for detection of tumor in multimodal Brain MR Images, in Section 3 this paper

discuss about the Framework for Detection of Tumor in multimodal Brain Magnetic Resonance Images, in Section 4 presents the results tested on multiple multimodal MR Image datasets and discussion about the results and in Section 5 presents the conclusion.

2. Literature review

The segmentation methods of the medical image are widely used for Magnetic Resonance (MR) image analysis [2] [3][4]. The similar researches have proposed multiple considerable algorithms for image segmentation in 3D Visual image analysis for detecting medical disorders. An extensive range of medical image segmentation techniques is being deployed to detect the brain tumors from the multimodal MR images. Some of the techniques [2][3][4][5][6]are compared here Table 1.Hence,with this understanding, the future direction is clear to have some segmentation method to improve the possibilities of the accuracy with the scope of reduced time complexity.

Table 1: MR Image Analysis Methods for Brain Tumor Detections

Existing state-of-art methods for detection of brain tumor	Analyses of methods for detection of brain tumor
Watershed Segmentation and Morphological Operation	Determines the abnormality presence, fully automatic algorithm, no prior information or training process needed. The Medium accuracy of the detection of brain anomalies for MR Image. Medium Accuracy and Medium Complexity. Its complex and tedious process for the detection of brain anomalies for MR Image.
K-Mean Technique	K-means algorithm presents K centers for each cluster and it is quick, strong and simple. High Accuracy and High Complexity. It presents superior results as dataset are well separated from each other.
Gaussian Mixture Technique	It gives model for density modeling and classification. Medium Accuracy and Medium Complexity
Expectation Maximization–Gaussian Mixture Technique	GMM is An automated algorithm and GMM algorithm used for segmentation of low-contrast, noisy MRI of the brain. Gaussian Mixture Models (GMMs) and EM is short of taking the spatial information and uncertainty of data into consideration and it presents the less accuracy.
Support Vector Mechanism	The Support Vector Machine method is widely used for high generalization performance, in particular,while the dimension of the feature space is very high. This method gives high Accuracy and Low Complexity for specific MR image data sets.

Thus,this work presents the improvement of the segmentation accuracy and detection of tumor in multimodal Brain MRI and also presents the comparative performance of the Fuzzy C-Means Clustering (FCMC), Watershed method and Proposed Method for the detection of tumor in multimodal Brain MR Images studies.

3. Framework for Detection of Tumor in Brain Magnetic Resonance Images

The primary objective behind this work is the detection of tumor in multimodal Brain MR Images and improves the segmentation accuracy and the detection of brain tumor in a multimodal Brain MR Image using FCMC method, Watershed method and proposed unification method. The visual representation of brain imaging relt in multimodal, such as T1 MRI, T2 MRI and FLAIR MRI. Hence, this work focused on enhancement of automatic segmentation accuracy and detection of Tumor in multimodal Brain MR Images using FCMC Method, Watershed Method and Proposed method. The block a diagram for the proposed work is shown in [Figure – 1] and it is equipped with the bilateral filter for the better segmentation of Brain MR Image and detection of brain tumor. The core framework of presenting approach has been demonstrated in (Figure-1).

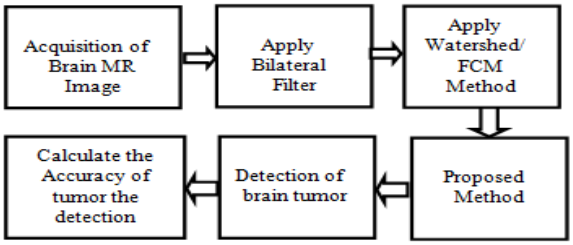

Fig.1. Block Diagram of the Proposed Work.

Development of a best possible unified framework to amalgamation of segmented regions by using existing state-of-the-art brain tumor segmentation methods like Fuzzy C-Means Clustering (FCMC) method and

Watershed method. The watershed [5] [6] [7] method is described as morphological gradient based segmentation for this work and the minimal watershed method .The objective of the watershed algorithm is to improve the accuracy of the image segmentation. FCMC method [8] [9] [10] is unsupervised automatic segmentation methods and it plays a vital role for segmentation and detection of anomalies in brain MR images and it accelerate the MR image segmentation process. The drawback of FCMC method is,the less segmentation accuracy for the detection of anomalies in multimodal brain MR images. The existing most accepted brain tumor segmentation methods Fuzzy C-Means Clustering (FCMC) method and Watershed method (WM) exhibits the limited segmentation accuracy for the detection of tumor in multimodal brain MR images.

The major focus of the proposed method is to enhance the accuracy of detection of tumor in multimodal Brain MR Image by finest merging [11] of segmented regions of Watershed and FCMC methods. The Proposed method is equipped with the bilateral filter to enhance the MR image edges for better segmentation and subsequently the bilateral filter is employed to the FCMC Method, Watershed Method and Proposed method for detection of tumor in Brain MR Images.

4. Results and Discussions

In order to demonstrate the results and theoretical construction presented in this work, we provide the MATLAB implementation of the framework to test the visual advantages of FCMC, Watershed and Proposed Method for the detection of tumor in multimodal Brain MR Images. The presented applications hav been tested for three patients of multimodal Brain MR Images and provided better results with proposed method.

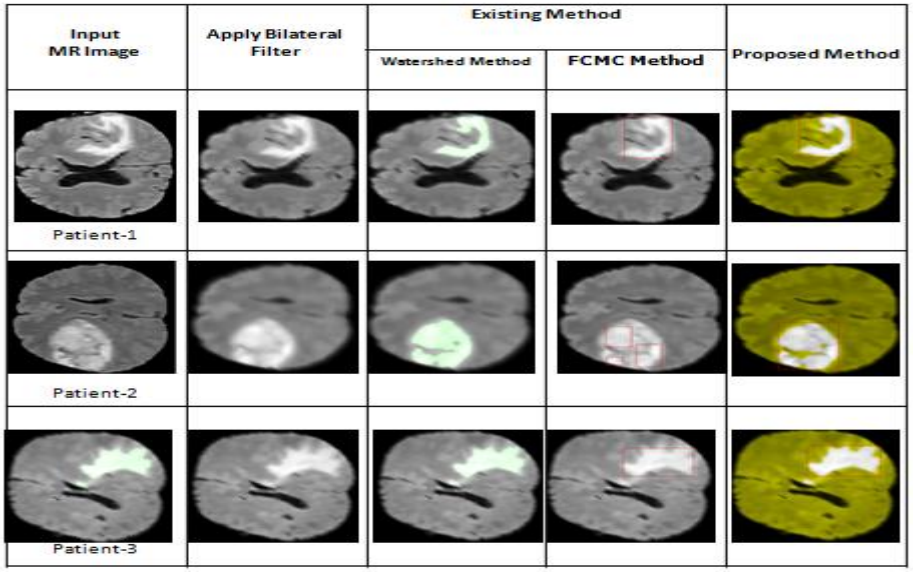

Fig. 2. Automatic Segmentation and Detection of tumor in real brain MR Image

In this work, we have analyzed the segmentation accuracy of FCMC, Watershed and Proposed Method for the detection of tumor in multimodal Brain MR Images and for this analysis; we have used the real brain MRI and datasets from the most popular multimodal brain MR image benchmark datasets, This contained the brain scan such as T1 MRI, T2 MRI and FLAIR MRI images along with their ground truth image. The segmentation results of the real multimodal brain MRI is shown in (Figure-2).

The accuracy of FCMC Method, Watershed method and Proposed Method is measured by finding the comparison between the tumor extracted from input multimodal Brain MR Images and the ground truth image of the parallel input image that is presented in the dataset. The comparative accuracy for FCMC, Watershed and Proposed Method is shown in Table 2 for three patient's multimodal brain MRI such as FLAR, T1 and T2.

The input multimodal Brain MR Image dataset is segmented with FCMC Method, Watershed method and Proposed Method.

Table 2: Analysis of Segmentation Accuracy

Input MRI	Multimodal MR Image	Segmentation Accuracy (%)		
		Watershed Method	FCMC Method	Proposed Method
Patient-1	FLAIR	98.01	97.78	**99.01**
Patient-2	FLAIR	98.11	97.12	**99.11**
Patient-3	FLAIR	97.66	97.02	**98.66**
Patient-4	T1	97.98	95.10	**98.98**
Patient-5	T1	95.36	95.63	**96.65**
Patient-6	T1	92.69	93.04	**94.04**
Patient-7	T2	96.33	93.71	**97.33**
Patient-8	T2	91.88	91.57	**92.88**
Patient-9	T2	88.48	85.5	**89.47**

Therefore,this work exhibits the relative performance of the Watershed Method, FCMC method and Proposed Method with the help of multiple Brain MR Image datasets for detection of brain tumor is depicted in [Table-2]. The testing results clearly demonstrate that the proposed method presents enhanced accuracy compared with the existing state-of-the-art brain tumor segmentation methods for Brain MR Images.

5. Conclusion

The extensive amount of analysis has been done for the detection of tumor in multimodal Brain MR Images with FCMC Method, Watershed Method and Proposed method. The proposed method in this work has been tested on the patient's different multimodal real Brain MR Image and benchmark datasets such as FLAR, T1 and T2 and demonstrated the development in the segmentation accuracy. The work also presented the relative analysis for multimodal Brain MR Image segmentation and detection of brain tumor. Quantitatively evaluated with the existing state-of-the-art brain tumor segmentation methods, outcomes, this work offered the improvement in detection of tumor in multimodal Brain MR Image. With the final outcome of segmentation accuracy development, this work surely and satisfyingly extends the possibilities of better segmentation and detection of tumor in multimodal Brain MR Images.

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