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Detection of Brain Tumor using Expectation Maximization (EM) and Watershed

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***Abstract*—** Human Body is made up of several cells which have their own capabilities. When these cells unrequitedly divide themselves, it develops into Tumor. The exact cause behind the loss of control over division is not known so far. Further growth of tumor would hinder the usual working of the brain. Hence detecting it in the first stage is necessary. It is a tedious task to accurately find the tumor. In case of Brain Tumor detection, there are several imaging techniques but MRI stands out with promising results. The proposed paper is motivated by the need for high precision when it comes to a human life. It considers MRI of brain and performs filtering, segmentation using Expectation Maximization and Watershed and also morphological operations. Later the results obtained from both the methods are combined to give a final image highlighting the tumor. Also, the accuracy of detecting the tumor is measured with the help of available truth images of MRI used.

***Keywords*—** MRI, Brain Tumor, Segmentation, Morphological Operations

I. INTRODUCTION

The body is comprised of numerous sorts of cell. Every kind of which has extraordinary capacities. Majority of them develop, afterward partition in a methodical way so new cells are framed. They are expected to retain body also functioning appropriately. These cells and spinal line together shape the Central Nervous System. At the point where the capacity to control their development is lost; separation takes place again and again, with no request. The additional cells shape a lump of the substance called a tumor. Identification of the brain tumor in its beginning time took after by treatment is the main cure of the sickness. The causes of the ailment are not clear nor are the explanations behind an expanded number of such cases. As of now, there are no techniques to counteract brain tumors, which is the reason early recognition speaks to an essential factor in tumor treatment. MRI is preferred standpoint over different imaging with delicate tissue yielding a point by point image with unambiguous and differentiating limits among anatomical structures. Exact estimations in the analysis are very troublesome in view of various shapes, dimensions and aspect of tumors. Thus consolidating the two strategies named EM (Expectation Maximization) and Watershed and getting the last yield, consequently expanding the precision of the framework.

This paper is organized as, Section I provides the Introduction and background, Section II contains information about previous work carried out, Section III contains Methodology used, Section IV provides Results and discussions, and Section V gives Conclusion and also the future work that can be performed.

II. RELATED WORK

Tumor within the brain can be detected using several other methods as performed by other authors are: In [1] author presents a target correlation of different calculations and methods utilized in pre-processing, Feature retrieval and division process. He centers on regulated and unregulated deterministic strategies. Contrasted with other pre-processing systems Optimized Kernel Possibilistic C-Means (OKPCM) calculation expels the commotion adequately from the Magnetic Resonance Image (MRI). At that point, Adaptive DW-MTM channel enhances the nature of MR Image. At that point Regression Neural Network portions the ROI from the foundation. So by using this progressive procedures and calculations Brain tumor can be effectively recognized and analyzed.

In [2] we get the distinctive parts of medical imaging particularly for the use of determination of brain tumor utilizing MRI. It exhibits the survey of various brain image division strategies introduced up until this point, also their favourable circumstances and hindrances are talked about as similar examination. Notwithstanding this, the data about various types of MRI pictures datasets which are often utilized for exploring considerations and in addition execution assessment measurements are made accessible.

In [4] author proposes five kinds of methodologies for Brain tumor location, distinguishing proof and

arrangement. It is the recognition of mind tumor through Magnetic Resonance (DICOM) Image utilizing Histogram Thresholding, K-mean division, FCM, Region developing and Watershed Segmentation. The proposed image preparing calculation depends on an altered Histogram Thresholding calculation. In any case, reenactment comes about utilizing this calculation demonstrated its capacity to precisely recognize and distinguish the shape of the tumor, its processing time and exactness were significantly less than its relating calculations.

In [6] presents a work done for programmed brain tumor finding, utilizing three kinds of a tumor which are an acoustic neuroma, astrocytomas, and optical glioma. Two frameworks are produced for determination. The first is a half and half framework formed PCA neural system, which goes about as an element deduction network, which derives the principal parts of MRI cases, and MLP network which acts as the classification network classifies the components. The performance increases with the number of components average being 78%. The second system is based on the classification of binary images resulting from WMEM segmentation algorithm. An average of performance is 88%. The time taken to classify is more is the disadvantage.

III. METHODOLOGY

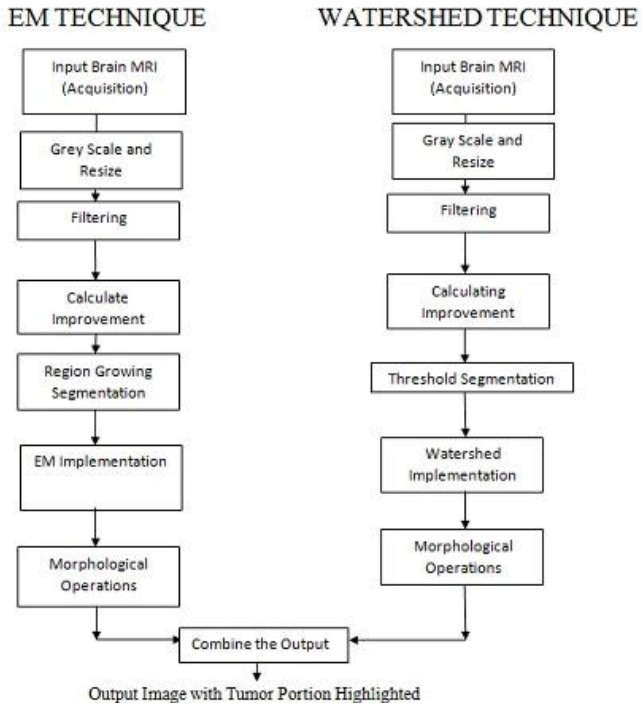

Figure 1. Block Diagram

Image pre-handling is chiefly basic for lessening the bothersome pixels and in this manner extending the clearness of image. Filtering is often the method which goes for the removal of noise, which may deteriorate an image in the thick of its obtainment or transmission, while still having retained quality. Here make use of trilateral filtering. Bilateral filtering has been connected to smooth through image while safeguarding the edges. Although to dodge overdoing it, a narrow window must be utilized. This will lead prompt a few cycles. Thus trilateral filtering will smooth through the images without going overboard with less number of repetitions. This stage additionally incorporates changing over the image to grey and also resizing.

Expectation Maximization

Expectation Maximization algorithm is a repetitive approach to determine the maximum likelihood of parameters. Main steps involved are:

1) The Expectation (E- step)

By utilizing current findings of parameters, calculate the expected value.

2) The Maximization (M- step)

Here, find parameter which maximizes the quantity.

3) Iteratively performing the E-step & M-step until convergence.

Steps are as below:

- Consider an MRI image.
- Convert it into gray form and perform other preprocessing.
- Generate an initial segmentation using region growing clustering.
- Feed these parameters obtained from the previous step to EM.
    - Estimate probability of data from the cluster.
    - For distribution within a cluster, update parameters built on probabilities of the previous step.
    - Repeat until convergence.

Watershed Transform

Watershed segmentation is a method based on gradients. Consider the gradient map of the image as a relief map. It segments the image as if it is dam. Regions which are segmented are called basins. Watershed segmentation provides solutions to several issues. Most likely to be used on images whose intensity is high. More often it overdoes the segmentation. To control over segmentation, marker-controlled watershed segmentation is used. Watershed works well if you can differentiate between foreground and background objects.

Steps involved are:

- Read in the Color Image and Convert it to Grayscale and perform other preprocessing.
- For Segmentation Function make use of Gradient Magnitude
- Point out Foreground Objects
- Calculate Background Markers
- From the Segmentation Function evaluate Watershed Transform.

IV. RESULTS AND DISCUSSION

To begin with, the user is presented with an interface. User has to browse the MRI image of which one is to find out if the tumor is present or not. Once we have browsed the MRI, is resized and transformed to grey form, after which Trilateral filtering takes place. On the other hand, Thresholding is also performed.

For Segmenting the MRI image there are two ways one is using EM algorithm and the second one is using Watershed algorithm. The segmentation is followed by Morphological operations. The tumor is detected and data from both the segmentations are saved. The results from both the segmentations are combined and compared with the truth image to get the accuracy level of detecting the tumor. The following images show the same.

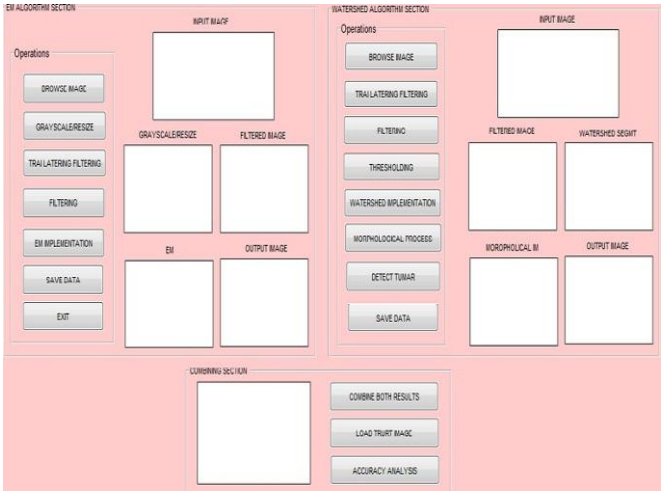

Figure 2. Initial Interface

Above Figure shows the GUI presented to the user initially. Figure 3 depicts the resized and filtered image.

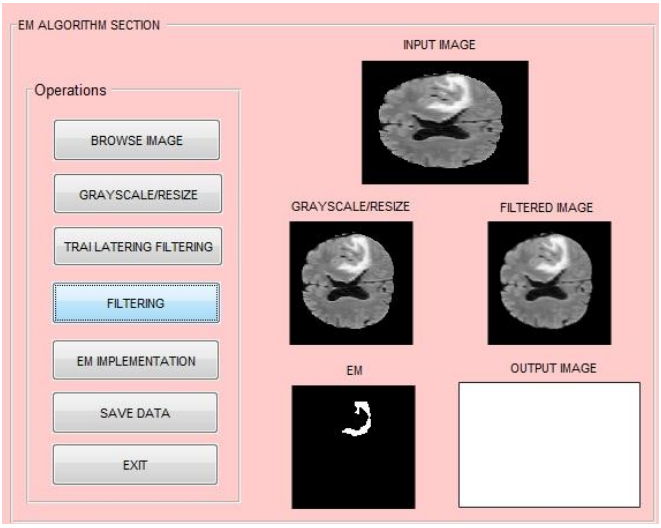

Figure 3. Trilateral Filtering

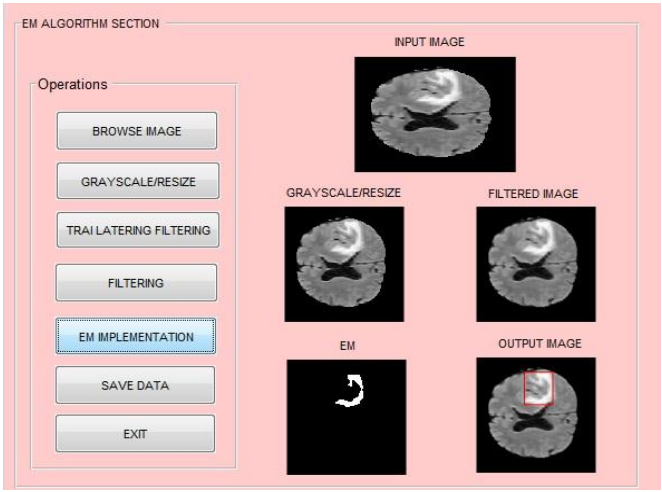

Figure 4. EM Output

Figure 4 shows the EM implemented image where the tumor is marked in red.

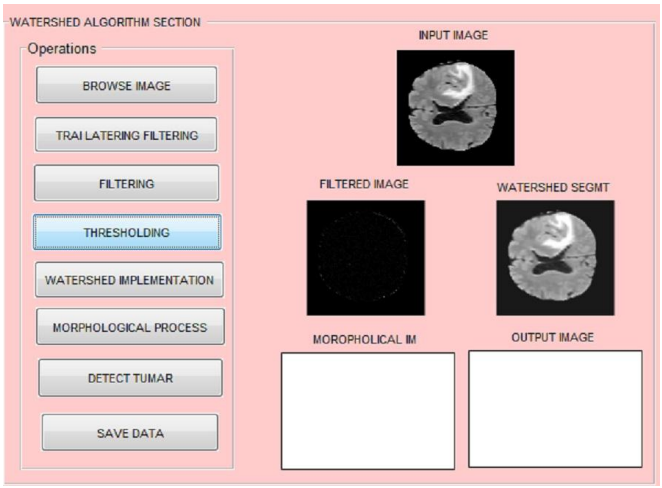

Figure 5. Filtering and Thresholding

Figure 5 shows filtering and Thresholding being performed on MRI followed by the Figure 6 which puts up the output of watershed with tumor marked in red.

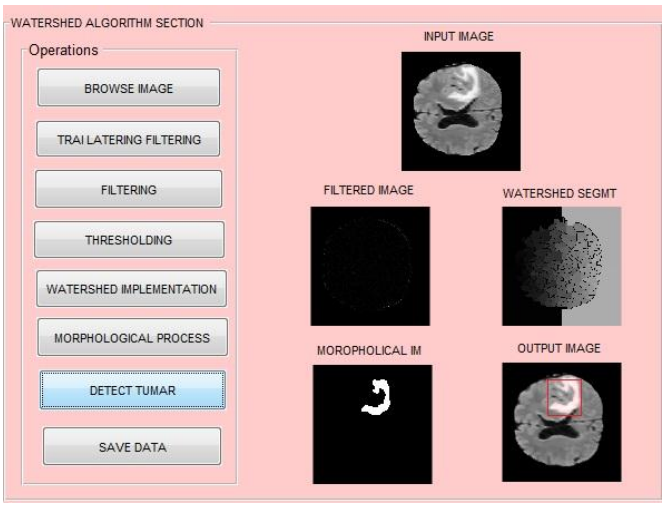

Figure 6. Watershed Output

Figure 7. Combine results

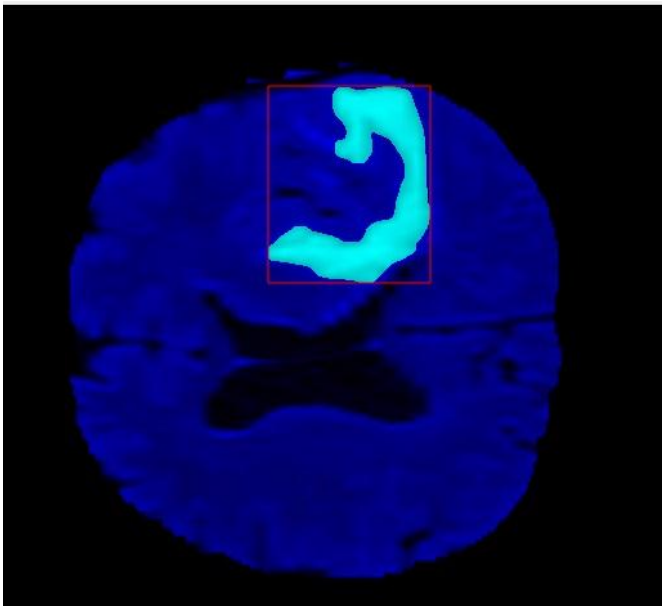

Figure 8. Final Output

Figure 7 and Figure 8 depict the process of combing the outputs of EM and Watershed segmentation and highlighting the tumor.

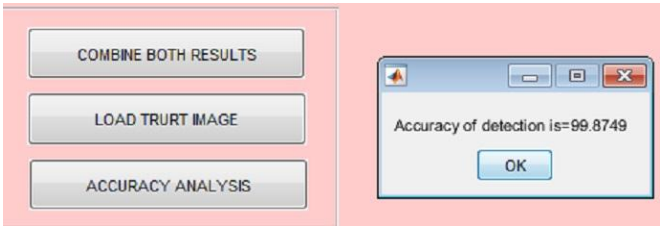

Figure 9.

Figure 9 shows the accuracy analysis carried out using the available truth images.

V. CONCLUSION and Future Scope

Detection of Brain Tumor application acts as powerful enhancements for any computer program interface. The proposed system is capable of handling MRI images. It helps in knowing the presence of tumor within the brain. It provides simple and yet easy interface for doing so. Here it uses two different algorithms namely EM and Watershed to see if there exists a tumor. Then both the computations are combined and accuracy levels are mentioned. Furthermore, it can be extended to work for other sorts of images and also can be extended to classify the type of tumor.

REFERENCES

[1] B. Suneetha, Dr. A. JhansiRani, "*A Survey on Image processing Techniques for Brain Tumor Detection Using Magnetic Resonance Imaging*", In the Proceedings of the 2015 IEEE International Conference on Innovations in Green Energy and Healthcare Technologies, Coimbatore, India,2015.

[2] Ruchi D. Deshmukh, Prof. Chaya Jadhav, "*Study of Different Brain Tumor MRI Images*", International Journal of Computer Science Engineering and Technology, pp. 133-136, 2014.

[3] Nilesh Bhaskarrao Bahadure, Arun Kumar Ray, Har Pal Thethi, "*Image Analysis for MRI Based BrainTumor Detection and Feature Extraction*", International Journal of Biomedical Imaging, pp 12, 2017.

[4] Richa Aggarwal, Amanpreet Kaur, "*Comparative Analysis of Different Algorithms For Brain Tumor Detection*", International Journal of Science and Research, Volume 3 Issue 6, pp 1159-1163,2014.

[5] Samjith Raj C.P, Shreeja R, "*Automatic brain tumor detection in T1 weighted magnetic resonance images*", In the Proceedings of 2017 IEEE International Conference on Innovation in Information Embedded and Computation Systems, 2017.

[6] Safaa E. Amin, M.A. Megeed, "*Brain Tumor Diagnosis System Based on Artificial Neural Networks and Segmentation using MRI*", In the proceedings of IEEE the 8th Conference on Informatics and Systems, pp 119-124, 2012.

[7] Manisha, Radhakrishnan.B, Dr. L. Padma Suresh, "*Tumor Region Extraction using Edge Detection Method in Brain MRI Images*", In the Proceedings of 2017 International Conference on Circuit, Power and Computing Technologies,2017.

[8] Hayder Saad Abdulbaqi, Mohd Zubir Mat Jafri, Kussay N. Mutter, Loay Kadom Abood, Iskandar Shahirm Bin Mustafa, "*Segmentation and Estimation of Brain Tumor Volume in Computed Tomography Scan Images using Expectation Maximization Algorithm*", In the proceedings of 2015 IEEE Student Conference on Research and Development, pp 55-60,2015.

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