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Image Processing Technique for The Enhancement of Brain Tumor Pattern

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***Abstract*--Brain tumor is an abnormal growth caused by cells reproducing themselves in an uncontrolled manner. Magnetic Resonance Imager (MRI) is the commonly used device for diagnosis. In MR images, the amount of data is too much for manual interpretation and analysis. During the past few years, brain tumor segmentation in Magnetic Resonance Imaging (MRI) has become an emergent research area in the field of medical imaging system. Accurate detection of size and location of brain tumor plays a vital role in the diagnosis of tumor. Image processing is an active research area in which medical image processing is a highly challenging field. Image segmentation plays a significant role in image processing as it helps in the extraction of suspicious regions from the medical image. In this paper image enhancement and noise reduction techniques are implemented. Apart from that different ways to detect edges and doing segmentations have also been used .The purpose of these steps is basically to improve the image and the image quality to get more surety and ease in detecting the tumor.**

1. Introduction:

Image processing is a process where input image is processed to get output also as an image or attributes of the image. Main aim of all image processing techniques is to recognize the image or object under consideration easier visually. Segmentation of images holds a crucial position in the field of image processing. In medical imaging, segmentation is important for feature extraction, image measurements and image display. A tumor can be defined as a mass which grows without any control of normal forces. Real time diagnosis of tumors by using more reliable algorithms has been an active of the latest developments in medical imaging and detection of brain tumor in MR and CT scan images. Hence image segmentation is the fundamental problem used in tumor detection. Image segmentation can be defined as the partition or segmentation of a digital image into similar regions with a main aim to simplify the image under consideration into something that is more meaningful and easier to analyze visually. Image segmentation methods can be classified as thresholding, region based, supervised and unsupervised techniques.

Magnetic resonance imaging (MRI), or nuclear magnetic resonance imaging (NMRI), is primarily a medical imaging technique used in radiology to visualize detailed internal structure and limited function of the body. MRI provides much greater contrast between the different soft tissues of the body than computed tomography (CT) does, making it especially useful in neurological (brain), musculoskeletal, cardiovascular, and oncological (cancer) imaging. Unlike CT, MRI uses no ionizing radiation. Rather, it uses a powerful magnetic field to align the nuclear magnetization of (usually) hydrogen atoms in water in the body. Radio frequency (RF) fields are used to systematically alter the alignment of this magnetization. This causes the hydrogen nuclei to produce a rotating magnetic field detectable by the scanner. This signal can be manipulated by additional magnetic fields to build up enough information to construct an image of the body

Clustering is division of data into groups of similar objects. The most popular clustering method is K-Means clustering algorithm. This algorithm is more prominent to cluster massive data rapidly and efficiently. So it can be used in image Segmentation of brain image is imperative in surgical planning and treatment in the field of medicine. In this work, we have proposed a computer aided system for brain MR image segmentation for detection of tumor location using K-Means clustering algorithm. The proposed brain tumor detection comprises three steps: image acquisition, pre-processing, and K-Means clustering. We were able to segment tumor from different brain MR images from our database processing techniques especially in segmentation. During the acquisition of medical images, there are possibilities that the medical image might be degraded because of problems that can occur during the acquisition stage. So the original image may not be suitable for analysis. Noise presented in the image can diminish the capacity of segmentation algorithm. So it is important to filter out any noise in the primitive image before segmentation. There is a wide range of filters available to remove the noise from the images. Average filters for example, can remove these noise but with the sacrifice of sharpness of image. Median filter is an example of average filter used to remove the noise like salt and pepper. Sharpening is generally achieved by using high pass filters. Gaussian filter (a high pass filter) is used to enhance the boundaries of the object. This is important as edges will detect and highlight the tumor for us.

In this paper image enhancement and noise reduction techniques are implemented. Apart from that different ways to detect edges and doing segmentations have also been used. The purpose of these steps is basically to improve the image

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and the image quality to get more surety and ease in detecting the tumor. The basic steps in preprocessing are the following:-

- Image is converted to gray scale image in first step.
- Noise is removed if any
- The obtained image is then passed through a high pass filter to detect edges.
- Then the obtained image is added to original image to enhance it.

2. Literature Survey:

Brain tumors are well known from the beginning of the 18th century. From then on being a period on researching on the various aspects of brain tumors. A lot of treatments are known to come and go from that period onwards. Later in the 19th century lot of societies and research institutes where set up in order to find imaging and treatment methods. Societies like The Brain Tumor Research Centre set up by Charles Wilson are doing various researches on tumor detection and treatments. Automatic segmentation algorithms are been developed recently to detect tumors within the brain. The images that are obtained through Magnetic Resonance Imaging or the Computed Tomography are taken to analyze the brain tumor. Some of the effects that are observed in these images which are taken either through MRI or CT may have artifacts, low contrast making the detection of brain tumor uneasy or noise present in those images. Hence it can be said that imaging here plays a central role in the segmentation or detection of brain tumor. Many imaging techniques are been used to detect tumors within the image. Algorithms like thresholding and region growing are been used to segment brain tumors. The existing method is based on k means clustering. When these methods were applied there are few disadvantages such as the thresholding method ignored spatial characteristics which are important for malignant tumor detection. Whereas in the region based segmentation it needed more user interaction for the selection of seed. Due to these drawbacks these techniques are not been widely adopted.

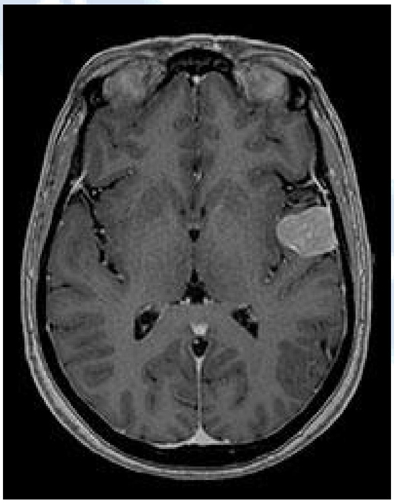

Fig 1. Original image

Fig 2 Clustering of brain MR image

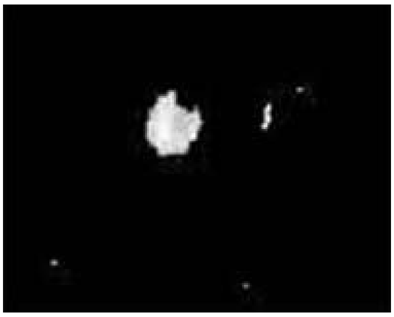

Fig 3 Tumor detected

Future research in the segmentation of medical images will lead towards improving the accuracy, exactness, and computational speed of segmentation approaches, as well as minimizing the amount of manual interaction. These can be improved by incorporating discrete and continuous-based segmentation methods. Computational effectiveness will be crucial in real-time processing applications. Segmentation methods have proved their utility in research areas and are now emphasizing increased use for automated diagnosis and radiotherapy. These will be particularly important in applications such as computer integrated surgery, where envision of the anatomy is a significant component.

3. Proposed Method:

3.1 Preprocessing:

In preprocessing some basic image enhancement and noise reduction techniques are implemented. Apart from that different ways to detect edges and doing segmentations have also been used. The purpose of these steps is basically to improve the image and the image quality to get more surety

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- Image is converted to gray scale image in first step.
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- Then the obtained image is added to original image to enhance it.

3.2 Processing:

In processing the following different steps are followed:-

Threshold Segmentation:
Segmentation is done on basis of a threshold, due to which whole image is converted into binary image. Basic matlab commands for thresholding are used for this segmentation.

Watershed Segmentation:
It is the best method to segment an image to separate a tumor but it suffers from over and under segmentation, due to which we have used it as a check to our output. We have not used watershed segmentation on our input, rather it is only used on our output to check of the result is correct or not and it give the correct answer every time as is shown below.

Morphological Operators:
After that some morphological operations are applied on the image after converting it into binary form. The basic purpose of the operations is to show only that part of the image which has the tumor that is the part of the image having more intensity and more area then that specified in the strel command.

Algorithm Used:
1. Let D be the data points in the given input image.
2. Partition the data points into k equal sets.
3. In each set, take the middle point as the initial centroid.
4. Compute the distance between each data point $di(1 \leq i \leq n)$ to all initial centroids $cj(1 \leq j \leq \ )$.
5. For each data point di, find the closest centroid cj and assign di to cluster j.
6. Set $clusterId[i] = j$.
7. Set $NearestDist[i] = d(di, cj)$.
8. For each cluster $j(1 \leq j \leq k)$, recalculate the centroids.
9. For each data point di,
(i) Compute its distance from the centroid of the present nearest cluster.
(ii) If this distance is less than or equal to the present nearest distance, the data point stays in the same cluster. Otherwise compute the distance $d(di, cj)$ for every centroid $cj(1 \leq j \leq k)$.
10. Repeat from steps 5 to 9 until convergence is met.

4. Results and Discussion:

We have mapped the resultant tumor image onto the original grayscale image for presentation purposes.

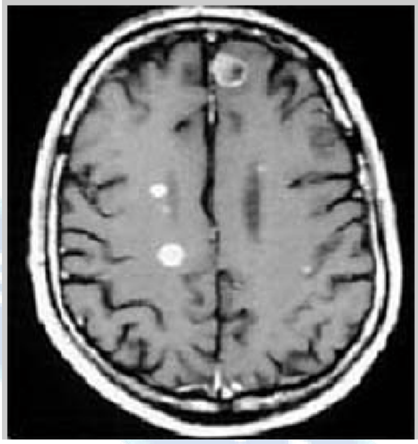


Fig 4 Input image of proposed methodology

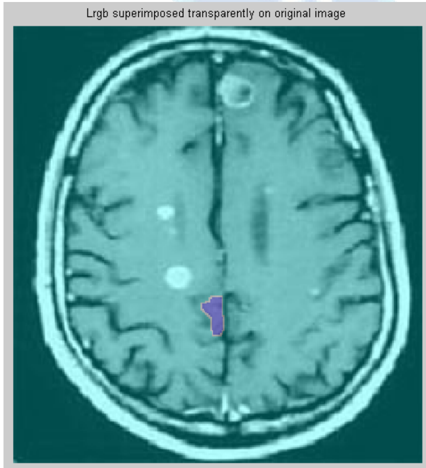
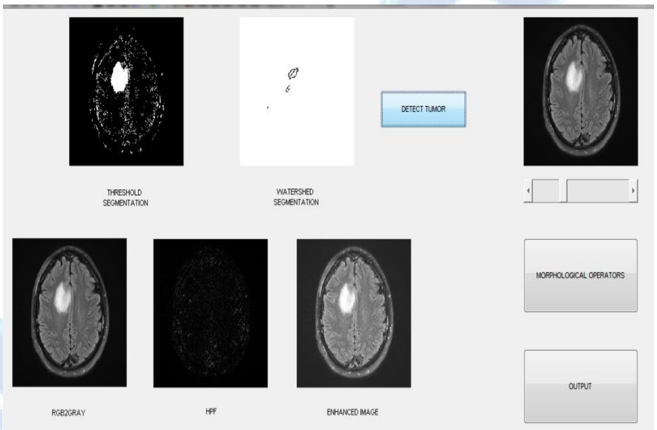
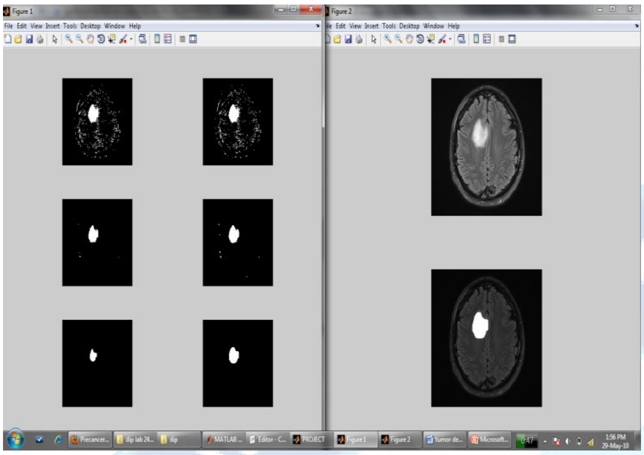


Fig 5 Output image of proposed methodology





5. Conclusion:

In this proposed work we acquire an MRI image of the brain and perform a series of operations to enhance the quality of the image and then to segment the tumor within the brain. This algorithm is able to segment tumors clearly and able to outline the shape and location of the tumor. This in turn helps the physician or the doctor to analyze the tumor shape and size since the shape and size of the tumor plays a vital role in the treatment to the tumor. In the future we will address simple algorithms to calculate the area and the thinness of the Tumor. We will also use simple algorithms to calculate the location of the tumor.

References:

[1] H. D. Cheng, Y. H. Chen, and X. H. Jiang, "Thresholding using two dimensional histogram and fuzzy entropy principle,Image Processing", vol. 9, pp. 732-735, 2000.

[2] M.S. Atkins and B.T. Mackiewich, "Fully Automatic segmentation of the brain in MRI", IEEE T. Med.Imag.,17:98–109.

[3] L.O. Hall and L.P. Clark, "Review of MR image segmentation techniques using pattern recognition",Med. Phys., 20:1033–1048, 1993.

[4] T.N. Pappas, "An adaptive clustering algorithm for image segmentation", IEEE T. Signal Process., 40:901 914,1992.

[5] Fan, J., Han, M. and Wang, "Single point iterative weighted fuzzy c-means clustering algorithm for remote sensing image segmentation Pattern Recognition", 42(11), pp. 2527—2540., 2009.

[6] Chen, J., Pan, D. and Maz, "Image-object detectable in multi scale analysis on high-resolution remotely sensed imagery",International Journal of Remote sensing, 30(14), pp. 3585–3602, 2009.

[7] Chen, Z., Zhao, Z., Gong, P. and Zeng, "A new process for the segmentation of high resolution remote sensing imagery",International Journal of Remote Sensing, 27(22), pp. 4991-5001., (2006).

[8] Bieniek, A. &Moga. (2000). "An Efficient Watershed Algorithm Based on Connected Components."PatternRecog, 33(6), 907-916.

[9] Abdel-HalimElamy, Maidong Hu. Mining "Brain Tumors & Their Growth rates".872-875 IEEE Image Processing Society, 2007.

[10] Rajeev Ratan, Sanjay Sharma, S. K. Sharma, "Brain Tumor Detection based on Multi-parameter MRI Image Analysis". ICGST-GVIP Journal, ISSN 1687-398X, Volume (9), Issue (III), June 2009.