Analysis, Brain Tumor Detection & Segmentation from MRI Images

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Abstract— During past few years, brain tumour segmentation in magnetic resonance imaging (MRI) has become an emergent research area in the field of medical imaging system. Brain tumour detection helps in finding the exact size and location of tumour. An efficient algorithm is proposed in this paper for tumour detection based on segmentation and morphological operators. Firstly quality of scanned image is enhanced and then morphological operators are applied to detect the tumour in the scanned image. The application of this method is equipped with the median filter to improve the brain MR image edges for better segmentation over the past few decades, several image compression standards have been proposed by international standardization organizations. This paper discusses the current status of these image compression standards in medical imaging applications together with some of the legal and regulatory issues surrounding the use of compression in medical settings.

Key words: Brain Tumor, MRI, Morphological, Operators, Segmentation

I. INTRODUCTION

Segmentation subdivides an image into its constituent regions or objects [1]. The main aim of segmentation is to find certain objects of interest which may be depicted in the image. But it is sensible to noise [7] [3]. That means if image contains noisy signals, results of segmentation are unpredictable. Noise is the random variation of brightness or colour information which is either due to technology limitation or environmental factor [1]. It is undesirable product. Therefore, before performing segmentation on images, it is necessary to remove noise from it. Although various spatial and frequency domain filtering techniques exist, in this paper morphological filters are used. Morphological filtering is combined with the watershed segmentation to yield good results. The acquired MRI scanned image, stored in database is converted to gray scale image of size 255*255, image is processed to remove any noise represent. Visual quality of noisy image will not be Satisfactory. The noiseless, high quality image is then operated by a high pass filter for sharpening and edge Detection. The obtained sharpened image is then added to original image for further enhancement.

A. Noise Removal

Many filters are used to remove the noise from the images. Linear filters can also serve the purpose like Gaussian, averaging filters. For example average filters are used to remove salt and pepper noise from the image. Because in this filter pixel's value is replaced with its neighbourhood values. Median filter is also used to remove the noise like salt and pepper and weighted average filter is the variation of this filter and can be implemented easily and give good results. In the median filter value of pixel is determined by the median of the neighboring pixels. This filter is less sensitive than the outliers.

B. Image Sharpening

Sharpening of the image can be achieved by using different high pass filters. As now noise is been removed by using different low pass filters, we need to sharpens the image as we need the sharp edges because this will help us to detect the boundary of the tumor. Gaussian high pass filter is used to enhance the boundaries of the objects in the image. Gaussian filter gives very high rated results and used very widely to enhance the finer details of the objects.

C. Segmentation

Image segmentation is based on the division of the image into regions. Division is done on the basis of similar attributes. Similarities are separated out into groups. Basic purpose of segmentation is the extraction of important features from the image, from which information can easily be perceived. Brain tumor segmentation from MRI images is an interesting but challenging task in the field of medical imaging.

D. Threshold Segmentation

Threshold segmentation is one of the simplest segmentation methods. The input gray scale image is converted into a binary format. The method is based on a threshold value which will convert gray scale image into a binary image format. The main logic is the selection of a threshold value. Some common methods used under this segmentation include maximum entropy method and k- means clustering method for segmentation.[10]

1) Morphological Operation

It is one of the best methods to group pixels of an image on the basis of their intensities. Pixels falling under similar intensities are grouped together. It is a good segmentation technique for dividing an image to separate a tumor from the image Watershed is a mathematical morphological operating tool. Watershed is normally used for checking output rather than using as an input segmentation technique because it usually suffers from over segmentation & under segmentation.[1] For using watershed segmentation different methods are used. Two basic principle methods are given below:

1) The computed local minima of the image gradient are chosen as a marker. In this method an over segmentation occurs. After choosing marker region merging is done as a second step
2) Watershed transformation using markers utilizes the specifically defined marker positions. These positions are either defined explicitly by a user or they can be determined automatically by using morphological tools.

II. LITERATURE SURVEY

The Magnetic Resonance Imaging (MRI) is a highly acceptable means than Computed Tomography (CT) to acquire high-resolution images of the brain of live subjects. Due to accuracy and soft tissues of brain contrast allows the discrimination of the nerve connection from the congregations of neurons and Cerebrospinal Fluid (CSF) (Ahmed and Iftekharuddin, 2011).

To support the diagnosis of various brain illnesses such as Alzheimer's disease, Dementia with Lowy bodies and Parkinson's disease, we need the analysis of the spatial distribution of those tissues. Previously, some of the methods like-manual slice editing, region painting and interactive threshold are used for medical image segmentation, which depends on human graphical interaction to define regions of interest. The different methods of image segmentation are classified into four main categories by Yong yang et al. (2007)

1) Threshold region growing and edge based techniques which are considered as classical methods.
2) The Maximum

Likelihood Classifier (MLC), which comes under statistical method. Basically, these methods are supervised and depend on the prior model and its parameters. André michael coleman (june 2008) found out reasonable opening results with Bayesian MLC. Proved the superiority of the neural network by making comparison between the MLC and the neural network classifier. From the last few years, some new methods of segmentation have been introduced, that could be classified as Statistical methods. A probabilistic supervised relaxation technique was applied for segmenting 3D medical images by (Matthew Deighton and Maria Petrou, 2003). This method provided the use of signals to lead the segmentation. Those signals marked by some of the parameters such as the mean and standard deviation.

3) (Shweta Jain, Shubha Mishra, 2013) worked on the neural network methods It is used to classify the type of tumor in MRI images of different patients with Astrocytoma type of brain tumor. The image processing techniques have been developed for detection of the tumor in the MRI images. Unsupervised Fuzzy C-means algorithm was provided by "MRI Fuzzy Segmentation of Brain Tissue Using Neighborhood Attraction with Neural-Network Optimization" (shan shen et al., 2005), Fuzzy clustering methods, which lead to the unsupervised technique in segmentation. But, the time complexity is more taken by the fuzzy c-mean algorithm was acknowledged. The regions of abnormality of the images are not properly segmented by the standard fuzzy clustering algorithm
4) (Chuang et al., 2006; Indah et al., 2011). MRI slices map in three directions which include in the brain MRI. Amongst, T1- weighted image, T2-weighted image and PD-weighted image are the three modes of the transverse slice mapping. Generally, high contrast and low noise characteristics consisting of T1 weighted MRI image, so that T1-weihted image segmentation algorithms are widely used. The accuracy of the multi-spectral image segmentation can often be higher than that of the singlechannel image segmentation, because, multi-spectral images composed by different modes are usually able to provide richer anatomy information. Multi-spectral image processing algorithms are usually more complex than the single-channel image processing algorithms, because the different modes have their own unique characteristics and different processing methods

III. PROPOSED METHOD

The main purpose of this work is to enhance the accuracy and to the find the relative performance of Watershed Method, EMGM Method and Proposed method segmentation for the detection of brain anomalies in MR Images. The magnetic resonance imaging techniques for producing the visual depiction of brain images result in different types of images such as MR Image,

The studies exhibits the accuracy of Contrast-enhanced MR images is elevated for detecting the anomalies. Tumor Therefore in this work we focus on Contrast-enhanced MR Images to carry out the segmentation Method, and Proposed method with ROI AND NON ROI algorithm .for the better segmentation of MR images and for detection of brain anomalies in brain.

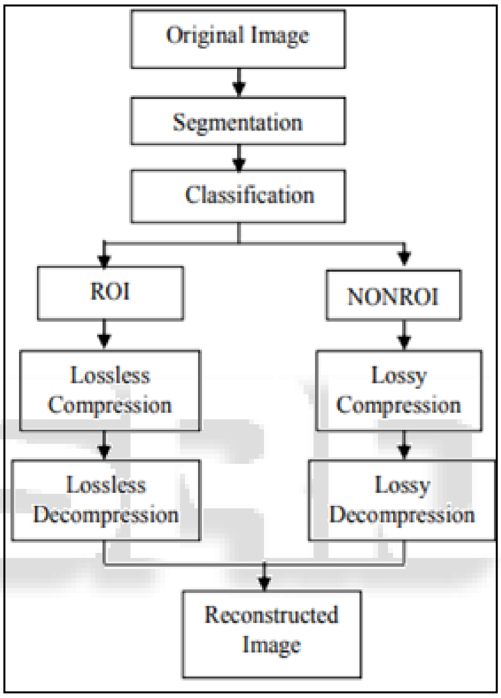

Fig.1 proposed method flow chart

1) Step 1: The method determines the number of segmented Brain MR Image regions in Watershed Method and EMGM Method.
2) Step 2: Compare all the segmented Brain MR Image regions of Watershed Method and EMGM Method to find the unique regions.
3) Step 3: Compare each Segment Brain MR Image from Watershed Method and EMGM Method to find the similar regions, if the regions are nearing neighbors, and then merge the regions.
4) Step 4: Mark the Brain MR Image regions with anomalies and detect the anomalous region on the Brain MR Image.

IV. EXPERIMENTAL OUTCOMES

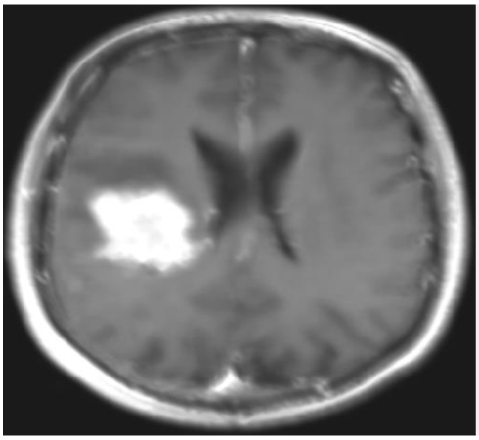

Fig. 2: Threshold Segmentation

First of all input image is shown here, figure 1 shows input images which has brain tumor. Threshold segmentation is applied on these images which contains brain tumor. The results are shown in the figure 1. In the following figure white spot is shown, which is the result of threshold segmentation applied on the images. This is basically the area with the intensity values higher than the defined threshold. High intensity areas mostly comprises of tumors. So through threshold segmentation we can specify the location of tumor.

Fig. 3: Output Image: Tumor is displayed as White Portion in the Image

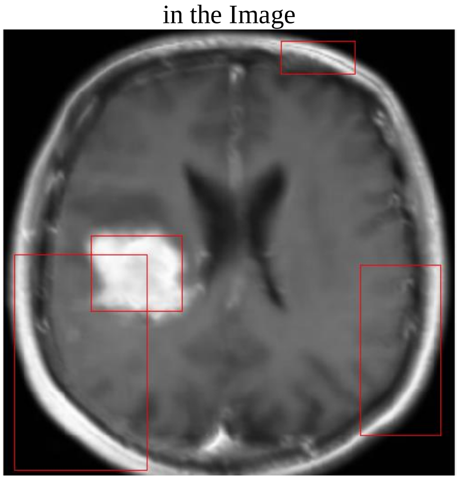

Fig. 4: Tumor Detected

Detected tumour in original image, the output of the threshold image is a binary image

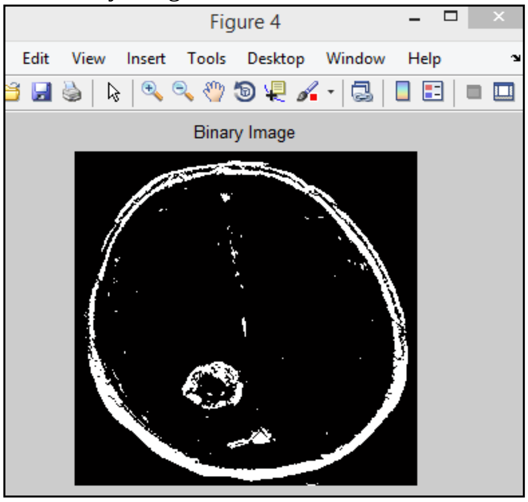

Fig. 5: Binary Image

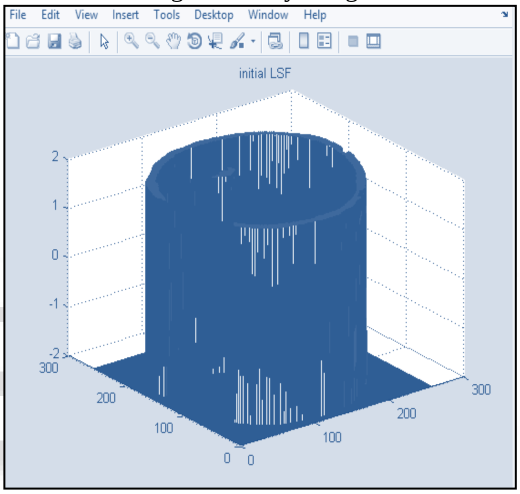

Fig. 6: Initial LSF Image

More features which help in classifying several types of the tumors

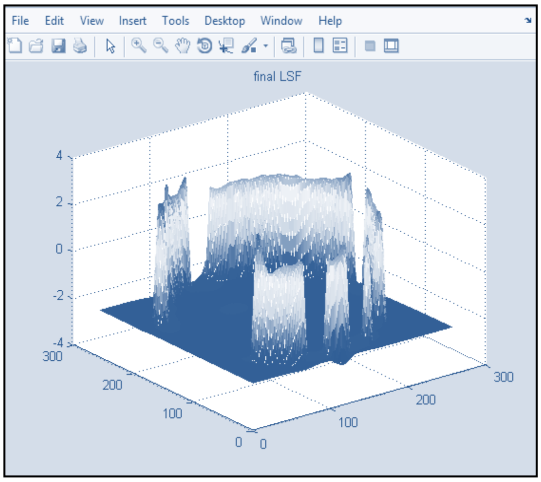

Fig. 7: Final LSF Image

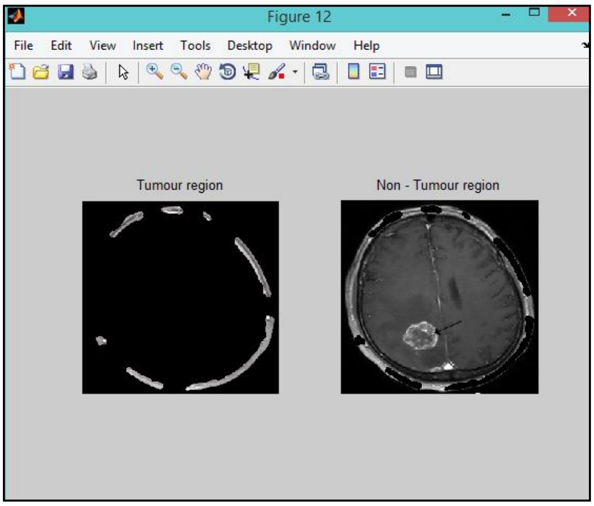

Fig. 8: Tumor Region & No-Tumor Region

V. CONCLUSION

Region of interest based hybrid compression techniques reduces the size of image while preserving the fidelity of diagnostically important regions. These techniques enable better image examination and also address the issues regarding image handling and transmission in telemedicine systems. Automatic segmentation procedure efficiently extracts the arbitrary tumor regions with less background present in ROI portion. Entropy based lossless compression encodes the ROI portion. This research was conducted to detect brain tumor using medical imaging techniques. The main technique used was segmentation, which is done using a method based on threshold segmentation, watershed segmentation and morphological operators. The proposed segmentation method was experimented with MRI scanned images of human brains: thus locating tumor in the images. Samples of human brains were taken, scanned using MRI process and then were processed through segmentation methods thus giving efficient end results. This technique gives efficient results as compared to previous researches. Experiments are applied on various images and results were extraordinary. Our proposed research is easy to execute and thus can be managed easily. Our future work is to extend our proposed method for colour based segmentation of 3D images. For this purpose we need a classification method to organize three dimensional objects into separate feature classes, whose characteristics can help in diagnosis of brain

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