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Thresholding and Filtering Based Brain Tumor Segmentation on MRI Images

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Abstract: ***The brain is the interior most part of the central nervous system and is an intracranial solid neoplasm. Tumour's are created by an abnormal and uncontrollable cell division in the brain. In this work, axial view of the brain image (2D) from MRI scan has been used because MRI scan is less harmful than CT brain scan. The study of brain tumor is important as it is occurring in many people. In this paper, an image segmentation process was proposed for the identification or detection of tumor from the brain. The methodology consists of the following steps: pre-processing by using grey-level, sharpening and median filters; segmentation of the image was performed by thresholding and also by applying the watershed segmentation. Finally the tumor region was obtained with its area [1].***
Keywords: Brain tumor, MRI, Thresholding, Filtration, Segmentation, Watershed, Pre-Processing.

I. INTRODUCTION

Threshold – based methods - Threshold-based method is a simple and effective segmentation method by comparing their intensities with one or more intensity thresholds. At present, threshold-based methods are classified into global and local thresholding. If an image contains objects with homogeneous intensity or the contrast between the objects and the background is high, global thresholding is the best choice to segment the objects and the backgrounds. When the contrast of an image is low, threshold selection will become difficult. Local thresholding can be determined by estimating a threshold value for the different regions from the intensity histogram. Due to the special structure of brain tumor , global Thresholding are mainly used to determine the approximate location of brain tumor in the brain. In most cases, thresholding is used as the first step in the segmentation process of brain tumor. Thresholding based segmentation is easy and effective technique but require prior knowledge about image.[2]

An idea behind writing this paper is to show the different effects of filtration and segmentation on brain MRI images using histogram based techniques. Section I contains the introduction. Section II contains literature review of the research work. Section III contains the filtration methods a] Laplacian filter b] Gaussian filter. Section IV contains experimental analysis which is shows the table 1.1 of sample original MRI images and difference between RGB to grey, histogram equalization, laplacian and Gaussian filter and binarization. In this paper 200 original images are taken on the way to find out various filteration and segmentation methods used in this paper, MRI images are obtained from the internet (BRATS-2012, MIDAS.) database. After obtaining image from filtration segmentation has done in Section V. section VI contains Result Analysis of various filtration and segmentation methods . Section VII concludes a detailed review work.

II. LITERATURE REVIEW

J. Vijay et.al : propose the work on automated brain tumor detection by using segmentation by k-means algorithm and object classification algorithm. They identified that a well known segmentation problem within MRI is the task of classification the tissue type which include White Matter (WM), Grey Matter (GM), Cerebrospinal Fluid (CSF) and sometimes pathological tissues like tumor.[3]

S.Koley et.al : propose the efficient work on tumor detection and segmentation of brain MRI for the purpose of determining the exact location of brain tumor using CSM based partitioned K-means clustering algorithm. CSM has attracted much attention as it has given efficient result as a self merging algorithm compared to other merging processes and the effect of noise is also less and the probability of obtaining the exact location of tumor is more. Their approach is much simpler and computationally less complex and computation time is very less. A.

Laxami et.al, : proposed the work on information (region of interest) in the medical image and thereby vastly improve upon the computational speed for tumor segmentation results. Significant feature points based approach for primary brain tumor segmentation was proposed. Axial slices of T1-weighted Brain[4]

MR Swapnil R. Telrandhe et al : Images with contrast enhancement have been analyzed. In order to extract significant feature points in the image, applied a feature point extraction algorithm based on a fusion of edge maps using morphological and wavelet methods. Evaluation of feature points thus obtained has been done for geometric transformations and image scaling. A region growing algorithm was then employed to isolate the tumor region. Preliminary results show that our approach has achieved good segmentation results. Also this approach was reduces a large amount of calculation. Future work will involve an investigation of the method in automatic 3D tumor segmentation, segmentation of ROI's in other medical images, as well as the importance of implemented technique in medical image retrieval applications.[5]

III. FILTRATION

Before segmentation filters are applied on the image to improve the quality of image and to remove noise from the image. The input gray image is first subjected to a Laplacian filter, which acts as the preprocessing block and then Adaptive Histogram Equalization (AHE) is applied to the image obtained after preprocessing as shown in Fig. 3. The Laplacian filter is an edge-sharpening filter, which sharpens the edges of the image.

1) *Laplacian Filter:* A Laplacian filter is an edge detector used to compute the second derivatives of an image, measuring the rate at which the first derivatives change. ... Laplacian filter kernels usually contain negative values in a cross pattern, cantered within the array. The corners are either zero or positive values.
2) *Gaussian:* A Gaussian filter is a linear filter. It's usually used to blur the image or to reduce noise. A Gaussian Filter is a low pass filter used for reducing noise (high frequency components) and blurring regions of an image. The filter is implemented as an Odd sized Symmetric Kernel (DIP version of a Matrix) which is passed through each pixel of the Region of Interest to get the desired effect.

IV. EXPERIMENTAL ANALYSIS

In this research paper total 200 online images are obtained from (BRATS-2012) database. Out of two hundred 102 images are used for this research work. The Graphical User Interface (GUI) is constructed for the classification of MRI images [10]. Original image is converted in Rgb to gray then it is converted into histogram equalization. After histogram equalization laplacian and Gaussian filter is applied on the image to increase the quality of image and to remove the noise from the image and binarisation has done, the comparison is shown below in Table-1.

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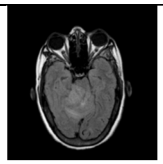
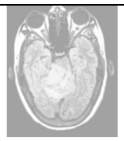
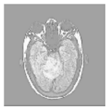
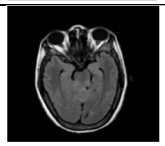
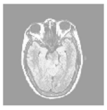
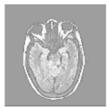
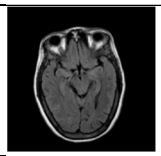
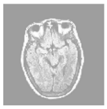
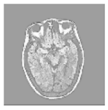
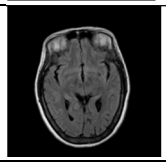
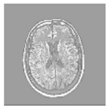
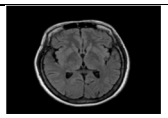
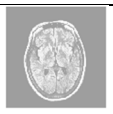
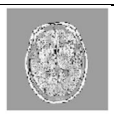
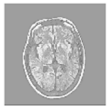
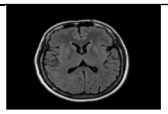
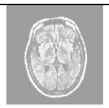
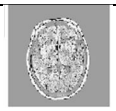
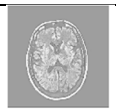
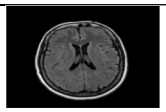
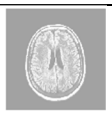
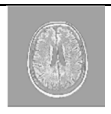
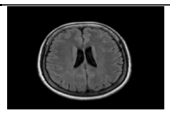
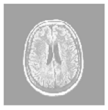
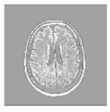
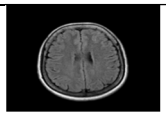
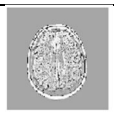
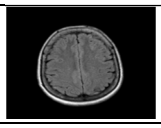
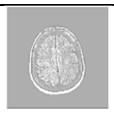
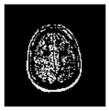
1						
2						
3						
4						

5						
6						
7						
8						
9						
10						

V. SEGMENTATION

Segmentation is a division or partition of digital images into various segments process. The purpose of segmentation is to make simpler the representation of the image which will be clearer and easier to analyse for further procedures. The image segmentation finds the objects in border and also it allocates the label to each pixel in the input image.[1]

A. Threshold-based Methods

Thresholding is used to convert gray scale image into binary image. This process of segmentation applies a single fixed criterion to all pixels in the image simultaneously.

B. Variable Thresholding

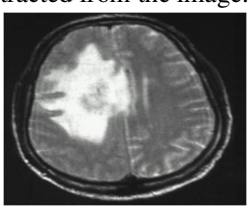
Variable Thresholding (also adaptive Thresholding), in which the threshold value varies over the image as a function of local image characteristics, can produce the solution in these cases.

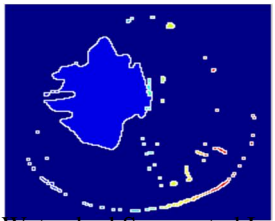
1) Image f is divided into sub images f_c
2) A threshold is determined independently in each sub image
3) If a threshold cannot be determined in some sub image, it can be interpolated from thresholds determined in neighbouring sub images. each sub image is then processed with respect to its local threshold.

$$T=T(f, fc)$$

C. Experimental Analysis

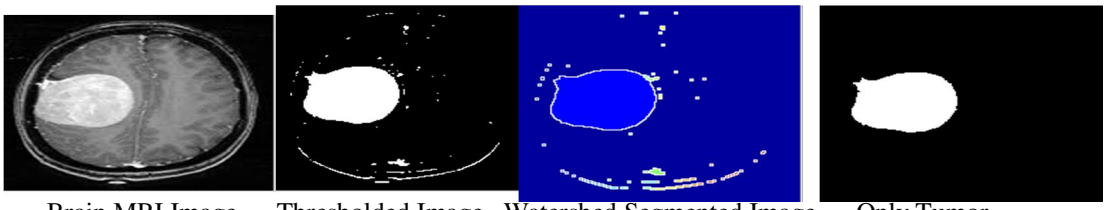
After binarisation and filtration segmentation has done with help of thresholding. Variable thresholding is used for segmentation. Below fig 1. Shows the segmented images, for segmentation first Brian image has taken which is a output of Gaussian filter. The input image is converted into thresholded image segmentation and watershed segmented image is applied on input MRI image and only tumor is extracted from the image.






Brain MRI Image Thresholded Image Watershed Segmented Image Only Tumor

Fig: 1



Brain MRI Image Thresholded Image Watershed Segmented Image Only Tumor

Fig: 2

VI. RESULT ANALYSIS

This paper shows the filtration and segmentation of MRI image first original image is converted into RGB to grey and then histogram equalization has taken after histogram laplacian and Gaussian filter has applied on MRI image, and binarisation has done on same MRI image all this process applied on that images as shown in the above table. The MRI records quantity is obtained on or after a virtual brain database (BRATS-2012).

After filtration segmentation has done on output, which has get from of Gaussian filter. In segmentation, first input image is divided into different segments and then Thresholding is applied on MRI images. The above figure Fig 1, and Fig 2 shows watershed segmentation and Thresholding of input MRI image. It concludes that the image is enhanced and quality of image is improved and noise of image has removed by various filtration and segmentation methods applied on MRI images.

VII. CONLUSION

This manuscript presents and idea to improve the quality of image and reduce noise from the MRI images, histogram equalization has done, various filters are applied, basic segmentation has done by variable Thresholding, suitable technique use for enrichment and improved the quality of image, and to reduce noise from the MRI image mentioned in above Figure. The value represent in above table shown the difference in between original image of MRI and histogram images showed that the quality of image is improved in histogram images. Noise is removed using laplacian and Gaussian filters and image segmentation has done by using Thresholding and watershed segmentation. In future many feature extraction methods would be use to extract the features from MRI images, and get more improved result.

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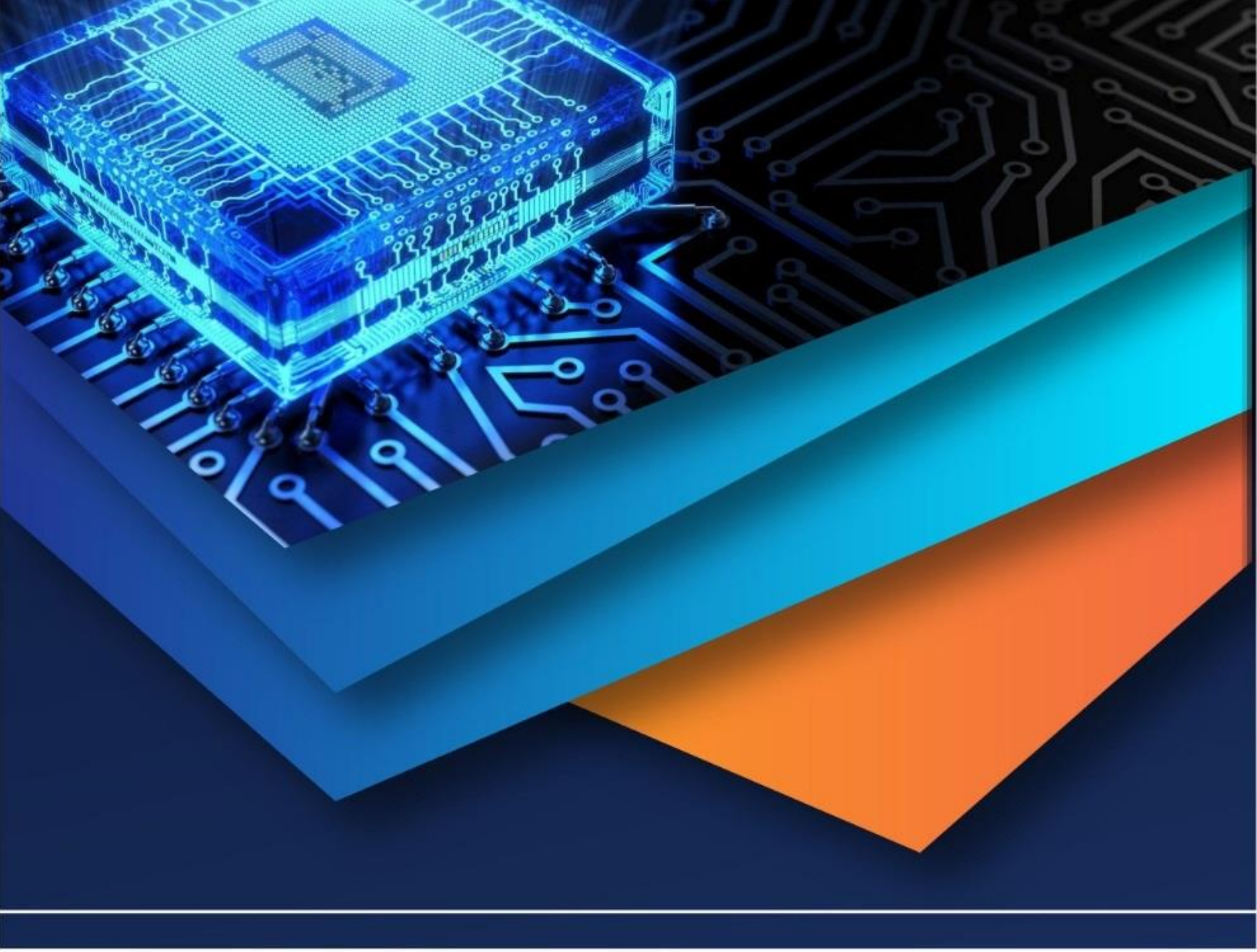

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