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Automated Brain Tumour Detection Using Image Segmentation, Density Based Technique

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ABSTRACT: Image segmentation is a process of partitioning a digital image into N regions. In today's world, Brain tumor detection using image segmentation is a fundamental but challenging problem in the field of computer vision and image processing due to the diverse image content, image noise, non-uniform object texture and other factors. Accurate detection of size and location of brain tumor plays a vital role in the diagnosis of brain tumor. There are many image segmentation methods available for medical image analysis but the density based and Edge based Detection are efficient, fast and accurate. This paper presents the efficient image segmentation algorithm i.e. Thresholding technique using MATLAB.

KEYWORDS: Image segmentation, Density Based, Edge Based Detection, Thresholding Technique

I.INTRODUCTION

Segmentation is used to subdivide an image to its regions for components or objects and it is an important tool used for medical image processing. It is an initial step used for segmentation which can be used for visualization, compression and identification. The images are segmented on the basis of a set of pixels in a region that are similar on the basis of some homogeneity criteria such as color, intensity, or texture which helps to locate and identify objects or boundaries in an image which is referred from s. Bauer's study, "a survey of mri-based medical image analysis for brain tumor studies," and "new variants of a method of mri scale standardization" by lászló g. Nyúl, jayaram k. Udupa*, and xuan zhang [1, 6]. By identifying all pixels (2d image) or voxels (3d image) which belong to an object, segmentation for that particular object will be achieved. Radiologists examine the patient physically by using computed tomography (ct scan) and magnetic resonance imaging (mri). Mri images showed the brain structures, tumor's size and location. From the mri images the information such as the tumor's location provided radiologists an easy way to diagnose the tumor and plan the surgical approach for its removal a. Sindhu 1, s. Meera2 "a survey on detecting brain tumor in mri image processing techniques" international journal of innovative research in computer and communication engineering vol. 3, issue 1, january 2015 [2].

This project shows a color-based segmentation technique that uses the color thresholding technique that is being carried out based on the adaptation and slight modification of the grey level thresholding algorithm. Multilevel thresholding has been conducted to the rgb color information of the bacterium to extract it from the sputum and other objects.

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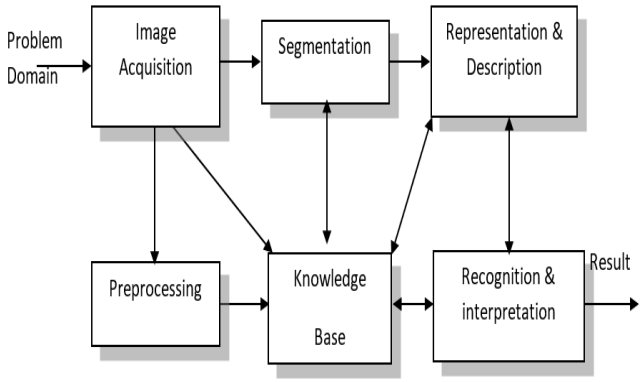

Fig. 1. Block diagram of fundamental sequence involved in an image segmentation

II.LITERATURE SURVEY

New Variants of a Method of MRI Scale Standardization by László G. Nyul, Jayaram K. Udupa*, and Xuan Zhang One of the major drawbacks of magnetic resonance imaging (MRI) has been the lack of a standard and quantifiable interpretation of image intensities. Unlike in other modalities, such as X-ray computerized tomography, MR images taken for the same patient on the same scanner at different times may appear different from each other due to a variety of scanner-dependent variations and, therefore, the absolute intensity values do not have a fixed meaning. We have devised a two-step method wherein all images (independent of patients and the specific brand of the MR scanner used) can be transformed in such a way that for the same protocol and body region, in the transformed images similar intensities will have similar tissue meaning.

N4ITK: Improved N3 Bias Correction by Nicholas J. Tustison*, Brian B. Avants, Philip A. Cook, Yuanjie Zheng, Alexander Egan, Paul A. Yushkevich, and James C. Gee A variant of the popular nonparametric nonuniform intensity normalization (N3) algorithm is proposed for bias field correction[5]. Given the superb performance of N3 and its public availability, it has been the subject of several evaluation studies. These studies have demonstrated the importance of certain parameters associated with the B-spline least-squares fitting. We propose the substitution of a recently developed fast and robust B-spline approximation routine and a modified hierarchical optimization scheme for improved bias field correction over the original N3 algorithm. Similar to the N3 algorithm, we also make the source code, testing, and technical documentation of our contribution, which we denote as "N4ITK," available to the public through the Insight Toolkit of the National Institutes of Health. Performance assessment is demonstrated using simulated data from the publicly available Brain-web database, hyperpolarized lung image data, and 9.4T postmortem hippocampus data.

III.EXISTING SYSTEM

- **Fusion Based:** Overlapping the brain image of the victim over a test image of the same age group, thereby detecting the tumor.
- **Canny Based:** To overcome the problem of detecting the edges, the better way is the use of canny based edge detection.

Disadvantages are

- The overlapping creates complexity due to different dimensions of both images.
- Time consuming process.
- Not support color images.
- This leads to an increase in time to reach the optimal solution.

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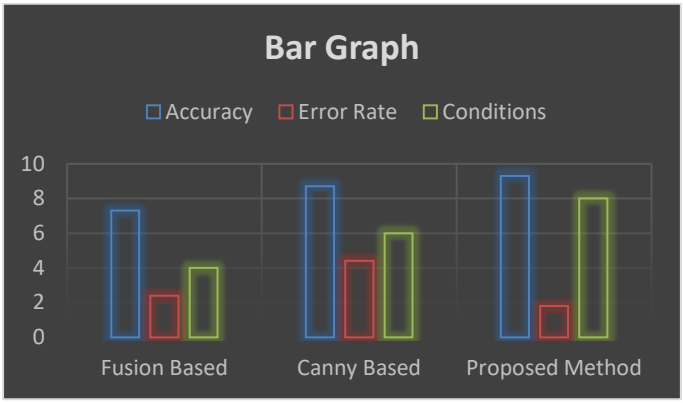

Fig.2. Comparing existing systems with proposed system

III.PROPOSED SYSTEM

In the proposed system image segmentation process and Anti-iso-diffusion filtering techniques are used for accuracy. In this we use thresholding technique to convert to binary format.
After converting into Binary, we used the "Regionprops" function in the morphological operation to extract the connected components. Based on "density" we find the exact location of the affected area.

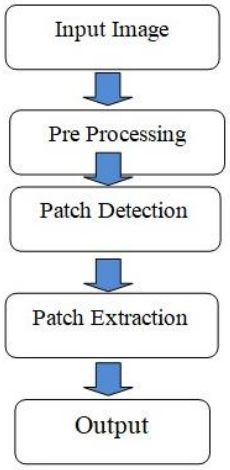

Fig. 3. Block diagram of Proposed System

ADVANTAGES OF PROPOSED SYSTEM:

- The result shows that the execution time is less.
- Density based checking is suitable for biomedical image segmentation as it uses unsupervised learning.
- By the use of morphological Filtering along with basic image processing techniques to meet the goal of separating the tumor cells from the normal cells.

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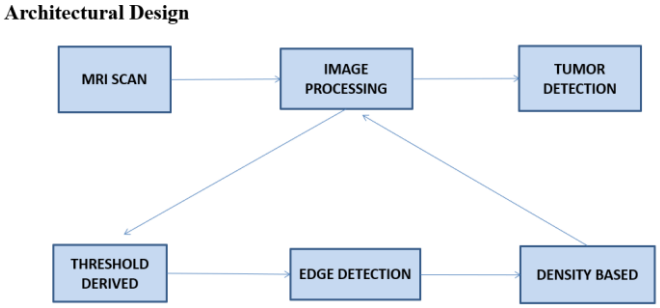

Fig.4 Image Pre-Processing

Pre-processing phase of our project mainly involves those operations that are ordinarily essential before the goal analysis and extraction of the required data and ordinarily geometric corrections of the initial image. These enhancements embrace correcting the information for irregularities and unwanted region noise, removal of non-brain element images and converting the data so that they are correctly reflected in the original image. The first step of preprocessing is the conversion of the given input MRI image into a suitable form on which further work can be performed.

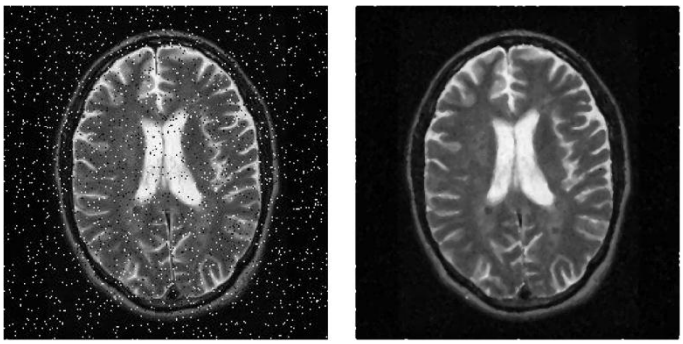

Fig. 5. Before and After removing Noise

Anisotropic Diffusion

It is a technique aiming at reducing image noise without removing significant parts of the image content, typically edges, lines or other details that are important for the interpretation of the image from the research done by R.C. Patil and Dr. A.S. Balachandran, "Brain tumor extraction from MRI images using MATLAB," International Journal of Electronics, Communication & Soft Computing Science and Engineering, vol. 2, pp. 1-4 [3]. Anisotropic diffusion resembles the process that creates a scale space, where an image generates a parameterized family of successively more and more blurred images based on a diffusion process.

Formula:

$$\frac{dI}{dt} = div(c(x,y,t)\nabla) = \nabla c.\nabla I + c(x,y,t)\Delta I$$

Thresholding Technique

Thresholding is the simplest method of image segmentation and the most common way to convert a greyscale image to a binary image.

In Thresholding, we select a threshold value and then all the gray level value which is below selected threshold value is classified as 0 and all the gray level which is equal to or greater than the threshold values are classified as 1.

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$$g(x,y) \int \quad 1 \ iff(x,y) \geq T \ 0 \ otherwise$$

Here g(x, y) Represent threshold image pixel at(x, y) and f(x, y) represent grayscale image pixel at (x, y) as referred from Mustaqeem, Anam, Ali Javed, and Tehseen Fatima, "An efficient brain tumor detection algorithm using watershed and thresholding-based segmentation", International Journal 4, 2012 [4].

Algorithm

- Read the target image into the MATLAB environment.
- Convert it to a grayscale image if the read image is an RGB image.
- Calculate a threshold value, T
- Create a new image array with the same number of rows and columns as original image array, containing all elements as 0
- Assign 1 to binary (i, j), if gray level pixel art (i, j) is greater than or equal to the threshold value, T; else assign 0 to binary (i, j).

IV.EXPERIMENTAL RESULTS AND ANALYSIS

Usually, most of the segmentation algorithms have been implemented using manual code in MATLAB but in this research, an attempt is made to implement the same using MATLAB but using thresholding, density-based technique with edge detection.

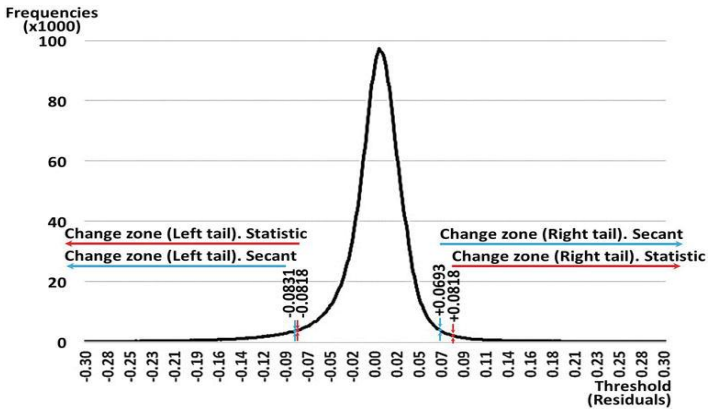

Fig.6. Accuracy Graph for using Threshold

Syntax for Region props function in the morphological operation:
stats = regionprops(BW, properties)
stats = regionprops(CC, properties)
stats = regionprops(L, properties)
stats = regionprops (,I, properties)
stats = regionprops(output,)

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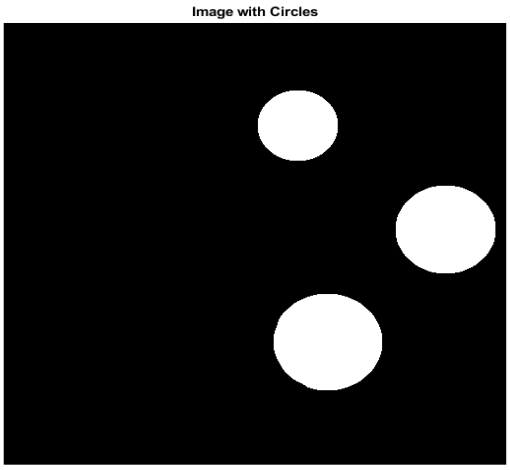


Calculate properties of regions in the image and return the data in a table.

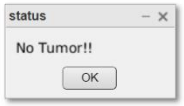
```
stats = regionprops('table',bw,'Centroid',...
    'MajorAxisLength','MinorAxisLength')
```

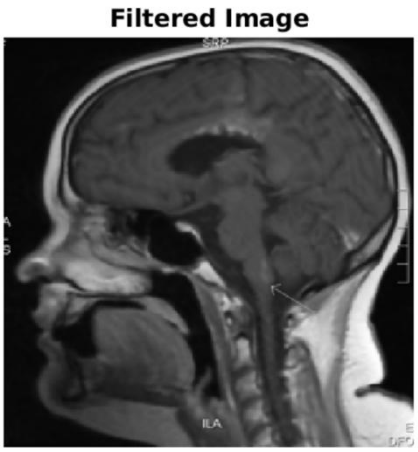
stats=4×3 table

Centroid		MajorAxisLength	MinorAxisLength
256.5	256.5	834.46	834.46
300	120	81.759	81.759
330.47	369.83	111.78	110.36
450	240	101.72	101.72

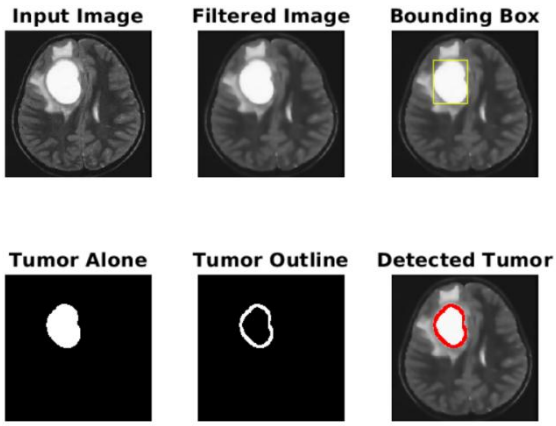
Below are the snapshots of the result showing the tumour detected

Test Case 1:

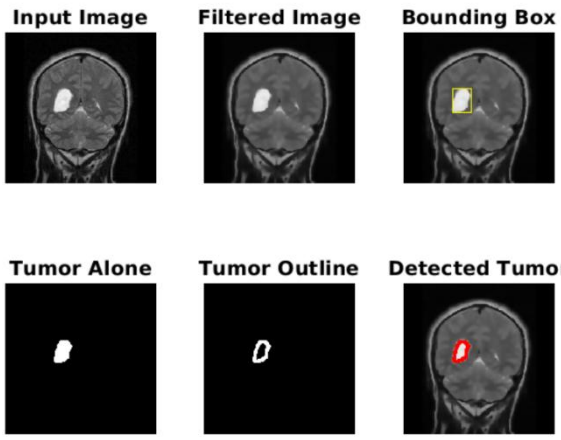




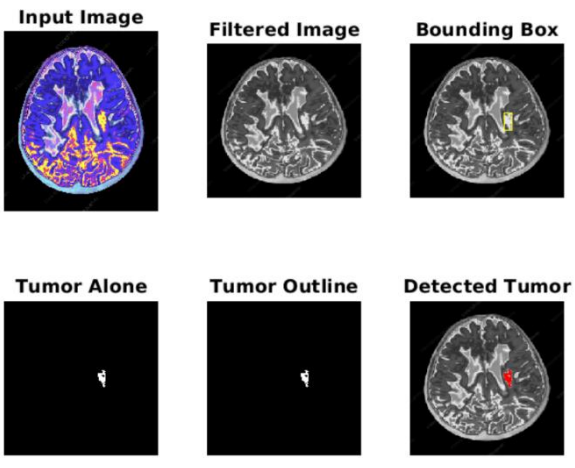
Test Case 2:



Test Case 3:



Test Case 4



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V.CONCLUSION

Image processing plays a vital role in today's world. Nowadays the applications of image processing can be found in areas like electronics, remote sensing, bio-medical and so on. various existing segmentation methods for brain MR image have been discussed. Using the knowledge from the above discussions our B. Tech project is proposed as Tumor Detection from MRI Images using Image Segmentation.

Our project was meant to help to detect the damaged tissues of the brain which leads to brain tumor. Every time it is not easy to detect the brain tumor condition in early stages. Our project helps in those *times.*

VI.FUTURE WORK

These tumors can be separated using diverse picture division techniques. The path toward recognizing cerebrum tumors through MRI pictures can be masterminded into four extraordinary territories; pre-planning, picture division, incorporate extraction and picture gathering.

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