ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 5, Issue 3 , March 2018

Brain Tumor Detection Using K-means Clustering and Threshold Segmentation

Deepak Agrawal , Vyom kulshreshtha, Dr. Pankaj Sharma

M.Tech Scholar, Department of Computer Science, Sachdeva Institute of technology, Mathura, Uttar Pradesh, India
Assistant Professor, Department of Computer Science, Sachdeva Institute of technology, Mathura, Uttar Pradesh, India
Professor, Department of Computer Science, Sachdeva Institute of technology, Mathura, Uttar Pradesh, India

ABSTRACT During past few years, brain tumor detection using image segmentation in magnetic resonance imaging (MRI) has became an emergent research area in the field of medical imaging system . In medical , image processing brain tumor detection is a challenging task .Brain tumor detection techniques helps to find out the location of the tumor and the exact size of the tumor . Images of the brain is difficult to understand . Image segmentation is a major area of medical image processing .Here in this paper an efficient algorithm is proposed for tumor detection based on greyscale image and segmentation technique .Firstly quality of scanned image is enhanced and sharpening the image. The objective of this paper is k-mean clustering and thresholding algorithms are applied to detect the tumor in the scanned image .

KEYWORDS: Image segmentation , Brain tumor , Noise removal method , k –mean clustering , thresholding technique .

I. INTRODUCTION

In this paper we study about image segmentation, that plays a important role in medical image analysis. Many segmentation methods have been proposed but none is universally applicable especially for medical images. There are different imaging modalities which includes magnetic resonance imaging (MRI), Ultrasound imaging . In medical imaging 3D image segmentation helps in automated diagnosis of brain diseases in quantitative and qualitative analysis of images such as measuring accurate size ,detection portion and .it is difficult to measure the accurate size in brain diagnosis because of appearances of tumor.

Image segmentation is the partitioning an image into a finite number of semantically non-overlapping regions. In medical applications, it is a fundamental process in most systems that support medical diagnosis, surgical planning and treatments. Generally, this process is done manually by clinicians, which may be time-consuming and tedious. [1].

Image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super-pixels). Image segmentation is also plays an important role in a variety of applications such as robot vision, object recognition, and medical imaging.The goal of segmentation is to evaluate or and change the representation of an image in some other manner that is more easier to analyze and meaningful. Image segmentation is typically used to locate boundaries (lines, curves, etc.) in images and objects.

In this paper to detect brain tumor , image segmentation is used k –mean clustering and threshholding technique. Firstly in first portion we take a grayscale image as a input .In second portion noise removal method are applied .In third portion ,image enhancement technique are applied on noisy removal image and at fourth portion k-mean clustering and thresholding algorithms are applied to detect tumor on that image. Some of the most popular algorithms are as Texture segmentation ,Template segmentation , Region growing segmentation ,Watershed segmentation .

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 5, Issue 3 , March 2018

II. RELATED WORK

This section deals with the work already been done in the field of medical imaging related to the brain tumor dectection. Major approaches of brain tumor detection are based on image segmentation. There are many researchers whose study in the area of image segmentation by different methods. The segmentation is application dependent and many segmentation schemes have been proposed based on different application of image segmentation .[2]. In many research papers researchers have used different methods based on k mean clustering, region growing based, and watershed segmentation for showing segmented results.

III. PROPOSED METHODOLOGY

There is never ending research in this field of image segmentation .Many researchers came up with different segmentation technique for efficient segmentation. Here in this research we present the two most efficient algorithm k mean and thresholding technique to detect brain tumor from grayscale image or MRI scan

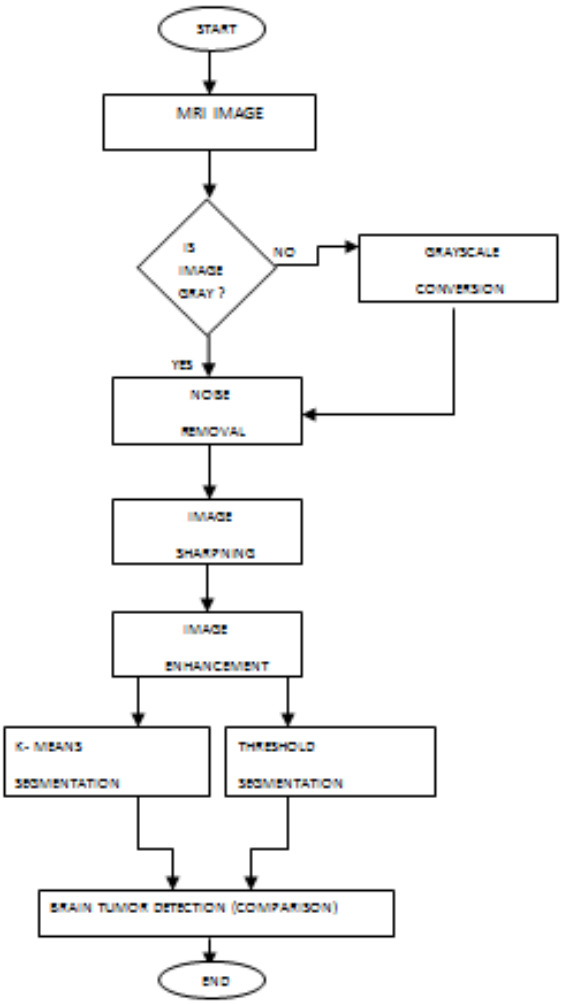

FIGURE 3.1 : BLOCK DIAGRAM OF THE PROPOSED IDEA

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 5, Issue 3 , March 2018

Steps of algorithm are as follow :

1. Take MRI scan of brain as input.
2. Convert it to greyscale image if it is not.
3. Then we apply noise removal on gray scale image .
4. Sharp the image
5. Pass the resulting image through median filter to enhance the quality of image
6. Compute K-means segmentation.
7. Compute thresholding segmentation.
8. Finally output will be a tumor region.
9. Compare the output of both the segmentations

All above steps are explained here in detail .

3.1 Greyscale Conversion:

Generally when we see MRI images on computer they looks like black and white images. Here at first stage MRI scanned image of the brain . At second stage we applied conversion process into greyscale image . greyscale is a range shades of grey without appearance color . In greyscale image the darkest possible shades are black and light possible shades are white . . For every pixel in a red-green-blue (RGB) grayscale image, R = G = B. The lightness of the gray is directly proportional to the number representing the brightness levels of the primary colors. Black is represented by R = G = B = 0 or R = G = B = 00000000, and white is represented by R = G = B = 255 or R = G = B = 11111111 .

3.2 Image Preprocessing:

In this phase the MRI scanned image is converted to greyscale image of size 255*255 . then the image is process to remove any denoising in the image .here denoising mean removing the noise from the image ,if the quality of the noisy image will not be satisfactory .

Noise Filter: Image noise is an undesirable and it does not maintain the image quality,extraneous information .There are two type of filters linear filters and non –linear filters . Linear filters are like Averaging filter ,Gaussian filters and it is also known as wiener filter . for example In averaging filter pixel's value is replaced with its neighbourhood value so it can be used to remove salt and pepper noise from the image .Weighted average filter is the variation of this filter and can be implemented easily and give good results .

Median Filter: In Non –linear filter ,median filter is used in this paper and it preserves with high frequency components from MRI without disturbing the edges also removes salt and pepper noise and impulses .In the median filter values of the pixels is determined by the median of the neighbourhood pixel's. Its main objective is to replace each pixel value in an image with the neighbouring pixels. Pixels are eliminated, when we use median filtering method to an image if the pixels values are very different from its neighboring.

Image sharpening and Enhancement : In this phase the term Image sharpening is refers to any enhancement technique that is to be highlighted edges and fine details in an image and noise is removed from an image .Most commonly used enhancement technique and removal methods are implemented that can give best possible results .Enhancement results are more prominent edges and a sharpened image are obtained ,noise will be reduced thus reducing the blurring effect from the image .additionally image segmentation are also applied to detect the brain tumor in enhanced image ,so its improving the quality of the overall images so at last stage edge detecgtion will lead to find the exact location of the tumor of the original image[3] .

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 5, Issue 3 , March 2018

3.3 Image Post-processing:

Segmentation : Image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels) and it based on the region growing segmentation Region-based methods mainly rely on the assumption that the neighbouring pixels within one region have similar value. The common procedure is to compare one pixel with its neighbours. If a similarity criterion is satisfied, the pixel can be set belong to the cluster as one or more of its neighbours. [4].

Segmentation using K – Means clustering: It is one of the best and simplest ,unsupervised clustering technique a cluster .Clustering is an unsupervised learning method which deals with finding a structure in a collection of unlabeled dataA cluster is a collection of objects which are similar between them and are dissimilar to the objects belonging to other clusters[5]. K-mean clustering is a clustering technique that groups N pixels of an image into K number of clusters, where K < n and K is a positive integer.
The main advantages of this algorithm are its simplicity and low computational cost, which allow it to run efficiently on large data sets. The main drawback is that: K the number of clusters must be determined [6], it does not yield the same result each time the algorithm is executed and the resulting clusters depend on the initial assignments of centroids.

The K-means clustering Algorithm is as follow :

1- Randomly select number of clusters K.
2- Randomly choose K pixels of different intensities as Centroids.
3- Centroids are finding out by calculating mean of pixel values in a region. Place Centroids as far away from each other as possible
4- Now, compare a pixel to every Centroid and assign pixel to the closest Centroid to form a cluster. When all the pixels have been assigned, initial clustering has been completed
5- Recalculate the mean of each cluster and recalculate the position of Centroids in K clusters based on Equation 3.1:

$$\frac{\sum_{i=1}^{m} 1\{C_i=j\}\, x^{(i)}}{\sum_{i=1}^{m} 1\{C_i=j\}} \qquad \text{.....(3.1)}$$

6- Repeat steps 4 & 5 until the Centroids no longer move.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 5, Issue 3 , March 2018

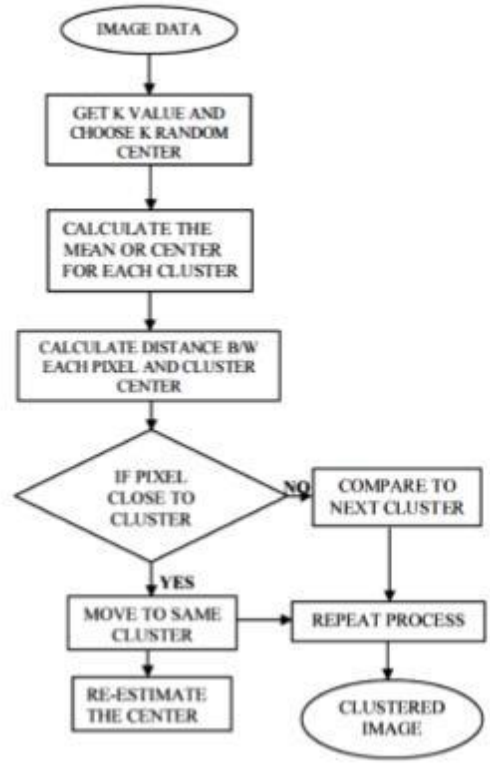

Figure 4.1 : Block diagram of K –Means method

Threshold segmentation: Threshold segmentation is one of the simplest segmentation methods .Greyscale image is converted into binary format ,this threshold segmentation method is based on threshold value where the conversion process can take placed from greyscale image to binary format .there are some common methods which is used in this segmentation like k mean clustering .

IV. EXPERIMENTAL RESULTS

Figure 5.1 shows as input image which has brain tumor thresholding segmentation and k –mean clustering algorithm are applied on this image which contain brain tumor to detect it.

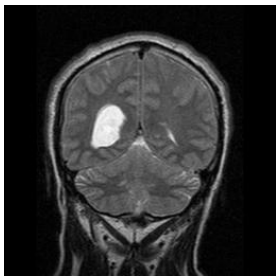

Fig 5.1. Input Greyscale image (original image)

Then we use noise removal method to remove the noise in this research in the original image there is a salt and pepper noise which is removed by median filter .which is shown in figure 5.2 :

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 5, Issue 3 , March 2018

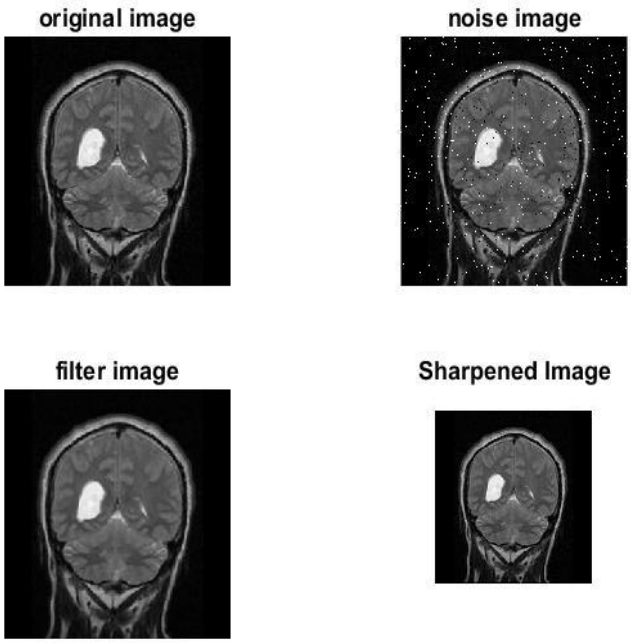

Fig 5.2 : (a) original image (grayscale image as a input), (b) noisy image, (c) filter image (after applying noise removal method on noisy image) ,(d) sharpened image (after applying the Gaussian high pass filter) .

After performing noise removal as pre-processing step, the sharpened image is segmented using K-means clustering algorithm described above. Various objects shown in the three clusters have shown in Fig. 5.3. The result of clustering have represented below in fig. 5.4.

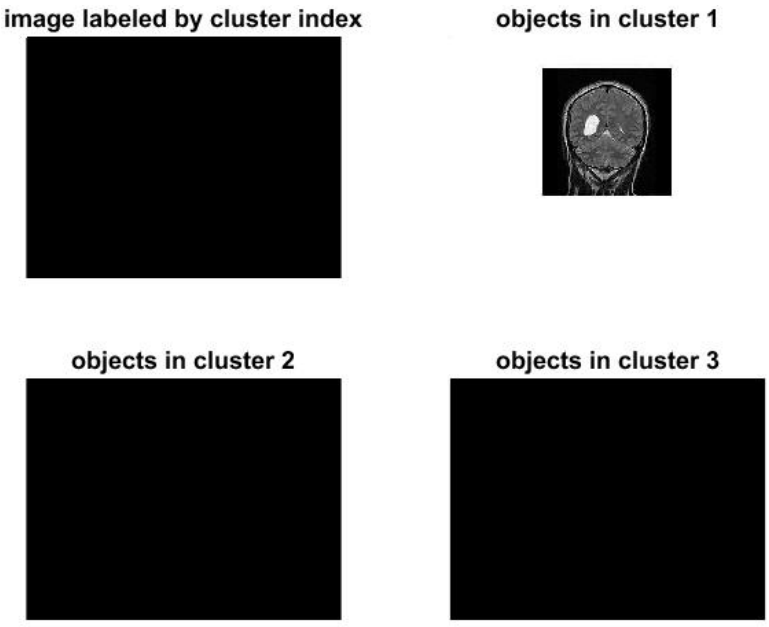

Fig. 5.3: objects in cluster

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 5, Issue 3 , March 2018

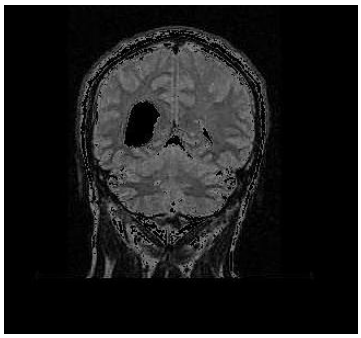

Fig. 5.4: k means clustering result

Fig. 5.5: Threshold image result

The clustered image is segmented using threshold segmentation. The segmented image is shown in Fig. 5.5. Threshold segmentation highlights the bright portion in the image by filtering lower frequency pixels. This bright portion represents the portion of brain tumor. We can diagnose tumor with exact location.
It can easily been seen that tumor detection based on only K-means clustering is difficult due to poor illumination of tumor region. To enhance the visibility of tumor, threshold segmentation has been done. The tumor can easily been detected as white spot in the segmented image.

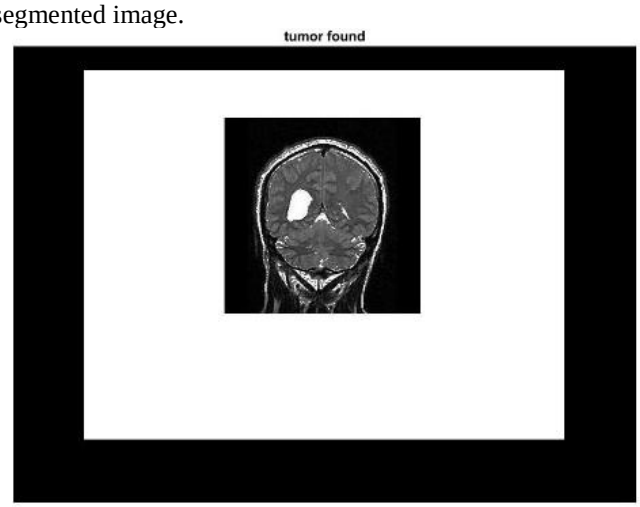

Fig. 5.6 Tumor detected as white spot

V. CONCLUSION AND FUTURE WORK

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 K-mean segmentation followed by threshold segmentation. 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. . These results will help doctors to diagnose the tumor more accurately and prepare plan of treatment. Our proposed research is easy to execute and thus can be managed easily.

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 5, Issue 3 , March 2018

Our future work is to extend our proposed method for color 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 diseases. Presently system is able to reduce impulse noise only. Some soft computing techniques such as neural network will be incorporated to make the system capable of identifying the noise model to improve the results in the presence of various sort of noise.

REFERENCES

[1]. ZHAO AND XIE: OVERVIEW ON INTERACTIVE MEDICAL SEGMENTATION 1 ANNALS OF THE BMVA VOL. 2013, NO. 7, PP 1–22 (2013)
[2]. IJERCSE 4 APRIL (2017)
[3]. AN EFFICIENT BRAIN TUMOR DETECTION ALGORITHM USING WATESHED AND THRESHOLDING BASED SEGMENTATION (12)
[4]. YU-HSIANG WANG, GRADUATE INSTITUTE OF COMMUNICATION ENGINEARING NATIONAL TAIWAN UNIVERSITY UNIVERSITY, TAIPEI TAIWAN, ROC
[5]. – LIANGE WANG, WEIMING HU, TIENIU TAN , RECENT DEVLOPMENT IN HUMAN MOTION ANALYSIS 2003
[6]. MARTIN HOFFMANN, PHILIPP TIEFENBACHER, GERHARD RIGOLL, BACHGROUND SEGMENTATION WITH FEEDBACK: THE PIXEL BASED ADEPTIVE SEGMENTER 2012 IEEE