International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-8 Issue-12, October 2019

Automatic Brain Tissue Segmentation using Modified K-Means Algorithm Based on Image Processing Techniques

Archana K.S, Kathiravan M, Sobana J, Gopalakrishnan.S, Ebenezer Abishek.B

Abstract: ***Brain tumor, due to uncontrolled development of abnormal cells, is one of the hazardous illnesses that happen in the brain. A fully automatic brain tissue segmentation using improved k means segmentation is discussed in this paper. Generally the brain tumor tissue can appear at any location at different size and shapes. Manual brain tumor detection is not only time-consuming, it is also linked to human errors and depends on the expertise and experience of a medical pathologist. Automatic detection is required in a computer-aided detection system (CAD) for medical images such as MRI. This automatic detection includes pre-processing, segmentation and medical image classification. The preprocessing techniques eliminate noise. Separate the region of interest from the background picture using the segmentation methods. Finally, the classification is conducted to identify brain tumor automatically. The outcomes are also compared between the suggested method and the current methods.***

Keywords: Image processing, MRI, brain tumor, preprocessing and segmentation.

I. INTRODUCTION

The body is made up of cells. Each cell has a unique quality, perform some specific functions. These cells grow and divide in orderly manner (P. Thirumurugan et. al. [8]). Some changes in the cell growth cause the cell to lose its capacity and in turn grow in disorderly manner. The excess cells formed in the brain leads to tumor. Identification and detection of tumor is performed using several methods

Revised Manuscript Received on October 30, 2019.
***** Correspondence Author
Archana K.S, Assistant Professor, Department of Computer Science & Engineering, Vels Institute of Science, Technology & Advanced Studies (VISTAS), Chennai, India.
Sobana J,Assistant Professor, Department of Information Technology, Rajalakshmi Engineering College ,Anna University, Chennai, Tamil Nadu 602105 India
Ebenezer Abishek.B, Assistant Professor, Department of Master of Computer Application, SRM Institute of Science and Technology, Chennai, India.
Kathiravan M, Associate Professor, Department of Electronics and Communication Engineering, Vels Institute of Science, Technology & Advanced Studies (VISTAS), Chennai, India.
Corresponding Author Mail id: archana.se@vleuniv.ac.in
Gopalakrishnan.S , Research Scholar Department of Electronics and Communication Engineering, Vels Institute of Science, Technology & Advanced Studies (VISTAS), Chennai, India.
Corresponding Author Mail id: archana.se@vleuniv.ac.in

The necessary resources for this phase include the picture of biomedical systems and methods such as X Ray, CT scan and MRI (N. Varuna Shree et. al[5]).
The automatic detection of brain image segmentation is by using magnetic resources have improved accuracy and the popular approach of this method is image recognition.
14.1 million individuals globally suffer from cancer and this disease has resulted in 8.2 million fatalities. Brain tumor treatment includes complex brain surgery. Brain disease therapy is a large-scale under research by accessible specialists (Zhenglun Kong et.al.[6]). It's also found that for detection the brain tumor automatically the segmentation algorithms are best suited.

II. RELATED SURVEY

The most challenging and upcoming field is brain tumor detection using medical imaging technique. The existing works based on various image processing techniques to detect brain tumor analyzes such as K-means algorithms, fuzzy clustering method, support vector machine, artificial neural network are analyzed. These are the most popular techniques used in medical image processing.
Joseph et al. [1] described the method to detect brain tumor analyzes using k-means segmentation from the various MRI brain images. The author has suggested Bahadure et al. [2] proposed a method to analysis MRI based brain tumor using the techniques such as BWT and the classification method of SVM techniques to detect brain tumor. Here, the author proposed the method with the classification accuracy upto 95% to eliminate the non brain tissues.
Cui et al.[3] suggested a technique for locating the image segmentation clustering technique using medical imaging. Using the method contour, Wang et al. created the technique for segmentation of brain tumors. Chaddad et al. [4] developed the method to detect the brain tumor using the feature extraction such as Gaussian mixture model from the MRI image. Here, the author achieved the accuracy upto 95%.

III. PROPOSED METHODOLOGIES

3.1 DATASET

Here, the dataset have 6 patients' of brain MRI images with the total of 500 images. After that, each images are resized as 256 x 256 pixel values. Then the value of pixel calculated as 0 to 255.
Finally, after reprocessing the images were stored for further processing. The structure of the MRI tissue finding is shown in Figure.1. given below.

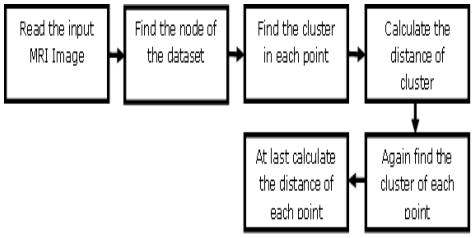


Figure 1. Architecture for MRI brain image segmentation

3.2 MODIFIED K-MEANS SEGMENTATION

There may be some overlapping areas on the brain structure in MR picture due to significant complicity. Hence this noise can be reduced for further processing. Through the segmentation process the image can be improved in both reliability and the efficiency using image processing applications. In preprocessing the process states with image enhancement to reduced the noise. Through the tissue identification the segmentation process can be improved. Because the noise occurring in skull can be decrease the accuracy of segmentation process and also it straightly affect the segmentation result. Segmentation used here to remove the undesirable noise in brain picture A. (Jayachandran and others [7]). Next, k-means altered segmentation algorithm used to segment the picture of the brain. The novel algorithm developed for the intended purpose is given below.

Algorithm: Modified k-means segmentation

Step 1: Read the input image
Step 2: Next, find the k cluster value for initialization
Step 3: Find the object to locate the cluster value.
Step 4: Then estimate the cluster value for to find the new value.
Step 5: Repeat step 3 and 4 to find the N objects.

In order to investigate the modified k means segmentation, the simulation of brain MRI images is segmented through k-means segmentation and modified k means segmentation respectively. Comparison of performance measurements such as jaccard coefficient, signal to noise ratio (SNR) and PSNR to assess the resemblance between two pictures.

The brain pictures of MRI are generally divided into gray matter, white matter, background picture, and cerebrospinal fluid. But in normal k-means segmentation based on the gray matter the values are calculated not included the adjacency of matrix and also the accuracy value of signal to noise level are very low. So in this modified k means segmentation the relationship of adjacency pixel values are calculated based on the same class.

Finally, the same class value can be built to enhance the precision of the formula-based noised MRI brain picture. morphological analyzes in this method to detect the tumor using the picture of the MRI.

$$C = \sum_{n=1}^{n} \sum_{m=1}^{m} \left\| x_j^i - y_i \right\|$$

Here, $\left\| x_j^i - y_i \right\|$ is measuring the distance between the pixel values.

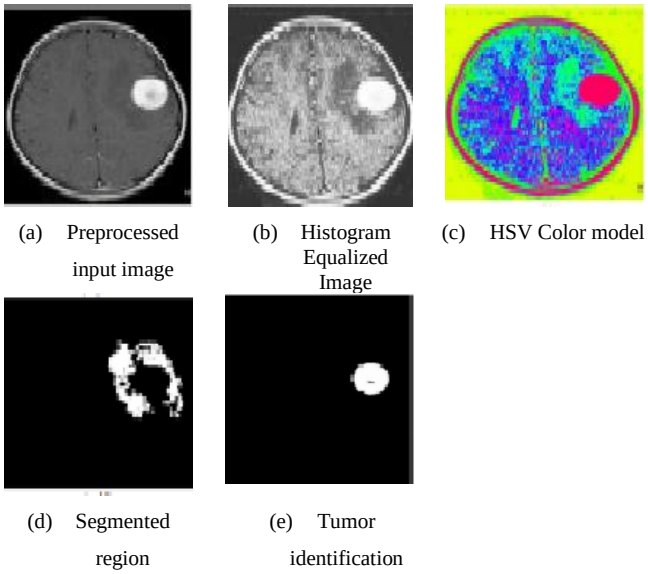
x_j is near cluster point, y_i is random sample values.

Finally, based on the cluster center point the classification accuracy can be improved in modified k-means segmentation and the formula as follows

$$max(x_{ij}) = x_{nm} => x_i \in x_n$$

The estimation of maximum cluster value is used to improve the accuracy level. Hence, this x_{ij} value assigned to each pixel to find the same class value.

IV. RESULTS AND DISCUSSION



(a) Preprocessed input image (b) Histogram Equalized Image (c) HSV Color model

(d) Segmented region (e) Tumor identification

Figure 2. Shows the various segmentation process

To decide the performance of the result the proposed algorithm is compared with the corresponding existing algorithm (Pim Moeskopset. Al. [9]). The proposed work is analyzed using the following the parameters Dice, Correlation coefficient and ssim.

Table1. Shows the comparison of proposed method

	Correlation Coefficient	Dice	SSIM
K-Means	0.01432	1.023654	1.04589
Improved K-means	0.15824	1.05489	1.05748

The enhanced segmentation algorithm for k-means is used to distinguish the tissue culture target region from the brain picture. Finally this improved algorithm is compared with existing algrithm. The results shows high accuracy of identification of tissue culture in the brain image. The results are classified according to the detection of defined location of brain tumor (Mohammadreza Soltaninejad et.al. 2016).

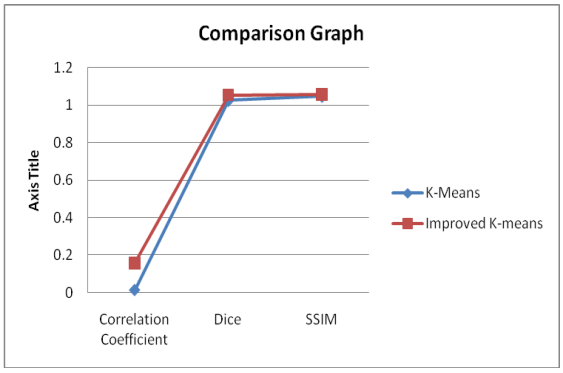


Figure 3. shows the comparison graph of proposed segmentation methods

V. CONCLUSION

The traditional algorithm k-means used to distinguish the region of concern from the picture of the background.Our proposed method clearly shows that normal and abnormal brain tissue which helps to idenfify the brain diseease diagnosis by clinicl experts. This altered k implies a successful segmentation technique from the MRI picture to segment the brain tumor. This suggested technique can therefore diagnose tumor much more quickly and precisely than manual assessment. Comparing the suggested technique with the current technique and attaining an enhanced level of precision shows that this methodology developed will be very helpful to humanity.

REFERENCES

1. Joseph RP, Singh CS, Manikandan M (2014) Brain tumor MRI image segmentation and detection in image processing. Int J Res Eng Technol 3, eISSN: 2319-1163, pISSN: 2321-7308
2. Bahadure NB, Ray AK, Thethi HP (2017) Image analysis for MRI based brain tumor detection and feature extraction using biologically inspired BWT and SVM. Int J Biomed Imaging 2017, Article ID 9749108.
3. Cui W, Wang Y, Fan Y, Feng Y, Lei T (2013) Localized FCM clustering with spatial information for medical image segmentation and bias field estimation. Int J Biomed Imaging 2013, Article ID 930301.
4. Chaddad A (2015) Automated feature extraction in brain tumor by magnetic resonance imaging using Gaussian mixture models. Int J Biomed Imaging 2015, Article ID868031.
5. N. Varuna Shree, T. N. R. Kumar, Identification and classification of brain tumor MRI images with feature extraction using DWT and probabilistic neural network, Brain Informatics, 2018.
6. Zhenglun Kong, Ting Li ,Junyi Luo, and Shengpu Xu, Automatic Tissue Image Segmentation Based on Image Processing and Deep Learning, Hindawi ,Journal of Healthcare Engineering, 2019.
7. A. Jayachandran · R. Dhanasekaran, Severity Analysis of Brain Tumor in MRI Images Using Modified Multi-texton Structure Descriptor and Kernel-SVM, Arab J Sci Eng (2014).
8. P. Thirumurugan, P. Shanthakumar, Brain Tumor Detection and Diagnosis Using ANFIS Classifier, Wiley Periodicals, Inc. 2016.
9. Pim Moeskops, Max A. Viergever, Adri¨enne M. Mendrik, Linda S. de Vries, Manon J.N.L. Benders and Ivana Iˇsgum, Automatic segmentation of MR brain images with a convolutional neural network, IEEE TRANSACTIONS ON MEDICAL IMAGING, 2016.
10. Mohammadreza Soltaninejad,Guang Yang2,3. Tryphon Lambrou1 ·Nigel Allinson,· Timothy L. Jones, Thomas R. Barrick,Franklyn A. Howe Xujiong Ye, Automated brain tumour detection and segmentation using superpixel-based extremely randomized trees in FLAIR MRI, Int J CARS, 2016.

AUTHORS PROFILE

Archana, Received Her Me In Computer Science Engineering From Sri Krishna Engineering College, Chennai In 2010 And Pursuing Her Ph.D In Computer Science Engineering From Vistas. Her Area Of Research Is Image Processing And Machine Learning.

Kathiravan, Received His Me In Computer Science Engineering From Sri Krishna Engineering College, Chennai In 2010 And Ph.D In Information And Communication Engineering From Anna University In 2019. His Principal Area Of Research Is Data Mining

Shobana, Received Her Me In Computer Science Engineering From Madha Engineering College, Chennai In 2008 And Pursuing Her Ph.D In Computer Science Engineering From Srm University. Her Area Of Research Are Data Mining And Machine Learning.

Gopalakrishnan, S Received His Master Of Engineering From Karpaga Vinayaga College Of Engineering And Technology In 2019 And Pursuing Ph.D In Electronics And Communication Engineering From Vistas. His Principal Area Of Research Is Antenna. His Area Of Interest Includes Antennas & Propagation, Electromagnetic Applications, Machine Learning, Wireless Communication, Embedded System, Image Processing And Robotics.

Dr.Ebenezer, Abishek.B Received His B.E In Electronics And Communication Engineering From Anna University, M.E In Vlsi Design From Anna University And Ph.D In Electronics And Communication Engineering From Vistas. He Is Currently, Working As An Assistant Professor In The Department Of Electronics And Communication Engineering, Vistas, With Teaching Experience Of Six And Half Years. His Area Of Interest Includes Antennas & Propagation, Electromagnetic Applications, Machine Learning, Wireless Communication, Vlsi And Robotics. He Has Presented Several Papers In Conferences And Won The Best Paper Award In International Conference Icctdsv'18. He Has Participated In Several Project Presentations And Won The Third Place At National Conference On Large Scale Multi-Disciplinary Systems Of National Significance Lamsys 2018 Conducted By Sathyabama Institute Of Science And Technology In Collaboration With Isro. He Is A Recognized Research Supervisor In Vistas Guiding 4 Research Scholars And Also A Dc Member For Research Scholars. He Has Published Several Articles In Reputed Journals.