

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

Archana K.S, Kathiravan M, Shobana 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

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.

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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.

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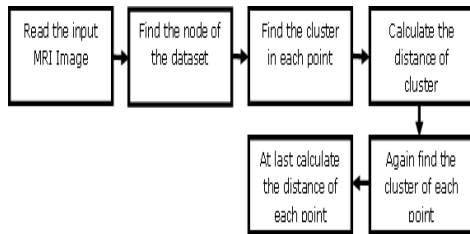


Figure 1. Architecture for MRI brain image segmentation

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.

$$c = \sum_{n=1}^n \sum_{m=1}^m \|x_j^i - y_i\|$$

Here, $\|x_j^i - y_i\|$ 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

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

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

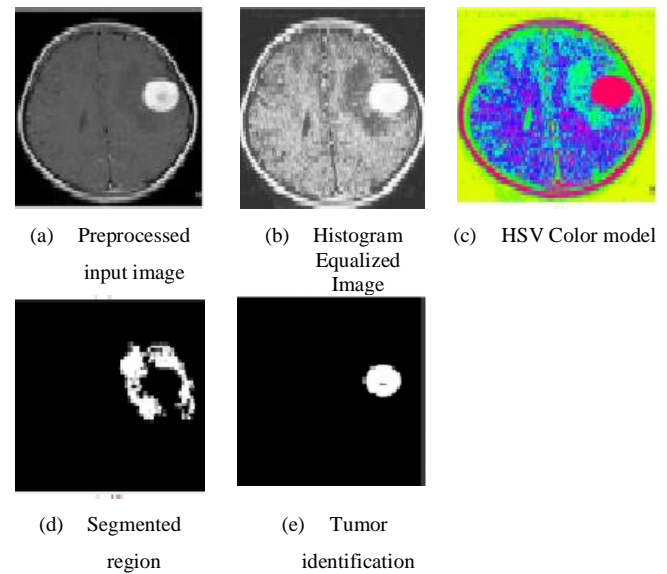


Figure 2. Shows the various segmentation process

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 algorithm. 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).

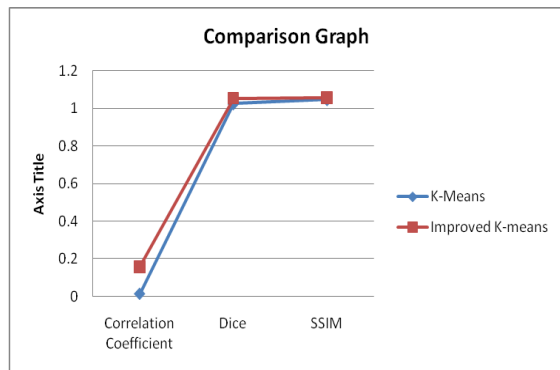


Figure 3. shows the comparison graph of proposed segmentation methods

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 identify the brain disease diagnosis by clinical 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.

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