Brain Tissue Segmentation by Modified K-Means Based on Image Processing

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ABSTRACT

One of the most dangerous diseases that can occur in the brain is a brain tumor caused by the uncontrolled proliferation of aberrant cells. This work discusses a fully automated brain tissue segmentation using an improved k-mean segmentation. In general, brain tumor tissue can form in any region and in a variety of sizes and shapes. The manual identification of brain tumors is not only time-consuming but also subject to human error and depends on the knowledge and experience of such a medical pathologist. Medical images such as MRI require automatic recognition within the computer-aided recognition (CAD) system. Pre-processing, segmentation, and medical image classification are all part of the automated detection process. Noise is eliminated using the pre-processing processes. Separate the regions from the background image using the segmentation methods.

Keywords: Image segmentation, Magnetic resonance imaging, brain tumor, CAD,Tissue

INTRODUCTION

Cells make up the human body. Each cell has a specific property and serves a specific purpose. These cells divide and grow in a regular pattern (P. Thirumurugan et al. [8]). Some changes in cell development cause the cell to lose capacity and expand in an unruly manner. Tumors are caused by an overabundance of cells in the brain. Several techniques are used to identify and detect tumors. Imaging of biological systems and procedures such as X-ray, CT scan and MRI are required resources for this phase (N. Varuna Shree et. al. [5]). Automated identification of brain image segmentation using magnetic resources has increased accuracy, and image recognition is a prominent technique for this procedure.

Cancer affects 14.1 million people worldwide, with 8.2 million people dying as a result of the disease. Complex brain surgery is required for the treatment of brain tumours. Brain illness treatment is being researched on a wide scale by available expertise (Zhenglun Kong et.al.[6]). It has also been discovered that segmentation techniques are best suited for autonomously detecting brain tumours.

LITERATURE REVIEW

Identifying brain tumors with medical imaging is the most challenging and promising area. Existing studies using different image processing approaches to identify brain tumors, including k-means approaches, fuzzy clustering methods, support vector machines, and artificial neural networks, will be evaluated. Which are the most commonly used techniques in medical image analysis. Joseph et al. [1] presented a technique for detecting brain tumors in MRI brain images using k-means segmentation. Bahadure et al. [2] provided a method for analyzing MRI-based brain tumors using methods that include BWT as well as the classification techniques of SVM approaches to brain tumor detection. To eliminate non-brain tissues, the author proposed a method with a classification accuracy of up to 95%.

Cui et al.[3] proposed using medical imaging to locate the picture segmentation clustering approach. Wang et al. developed a strategy for segmenting brain tumours using the contour approach. Chaddad et al. [4] created a technique for detecting brain tumours in MRI images by extracting features such as the Gaussian mixture model. The author attained an accuracy of up to 95% in this case.

PROPOSED METHODOLOGIES

DATASET

The data set contains brain MRI images from 6 patients with a total of 500 images. Each image is then reduced to 256,256 pixel values. The pixel value is then calculated as a number between 0 and 255. Finally, after reprocessing, the photos were saved for future processing. The pattern of MRI tissue detection is shown in Figure 1.

The separation between both the pixel values is measured here, $(X^{i}_{j-yi),}$xj represents a cluster point, while yi represents random sample values. Finally, depending on the cluster centre point, the classification accuracy using modified k-means segmentation may be enhanced using the formula shown below.

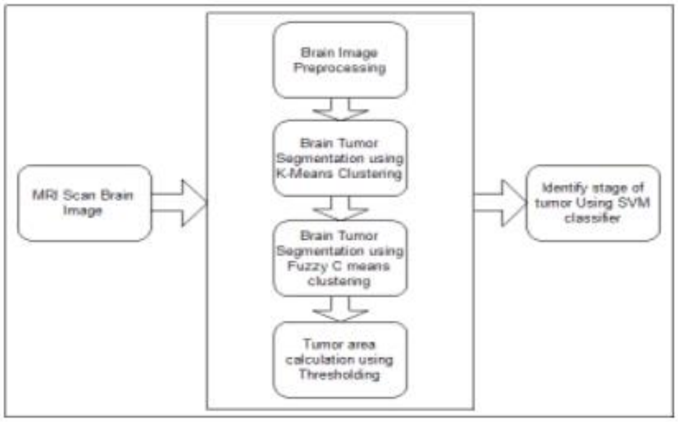

Fig: Architecture of segmentation of MRI brain images

SEGMENTATION BY MODIFIED K-MEANS

Due to significant complicity, there might be some overlapping regions on this brain structure in the MR image. As a result, this noise can be minimized for subsequent processing. With image processing programs, the image can be enhanced both reliably and efficiently through the segmentation process. The process states are pre-processed using image enhancement to remove noise. The segmented process can be enhanced by using tissue identification. Because noise in the skull can reduce the accuracy of the segmentation process and directly affect the segmentation result. Segmentation was used to eliminate the unwanted noise in brain image A (Jayachandran et al [7]). Subsequently, the k-means modified segmentation technique was used to separate the brain image. The innovative algorithm developed for this purpose.

Algorithm: Modified k-means segmentation

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

To examine modified k-mean classification, brain MRI images are segmented using k-mean segmentation and revised k-mean segmentation, respectively. To analyze the similarity of two images, performance parameters such as Jaccard coefficient, signal-to-noise ratio (SNR) and PSNR are compared. MRI brain images are classified into gray matter, white matter, background image, and cerebrospinal fluid. However, with the standard k-means segmentation based on gray

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matter, the values are calculated without considering the matrix neighborhood and the overall accuracy of the signal-to-noise level is relatively poor. As a result, in each modified k-mean segmentation, the connection of adjacent pixel values is determined using the same class.

$$c = \sum_{n=1}^{n}\sum_{m=1}^{m}\left\|x_j^i - y_i\right\| \qquad \boldsymbol{max}(\mathbf{x_{ij}}) = \mathbf{x_{nm}} \Rightarrow \mathbf{x_i} \in \mathbf{x_n}$$

Therefore, the same class value can be generated to improve the accuracy of both formula-based noisy brain MRI images. Morphological analyzes are used in this approach to detect tumors from MRI images. The maximum cluster value estimate is used to increase the level of accuracy. As a result, this xij value is assigned to each pixel to determine the identical class value.

RESULTS AND DISCUSSION

The proposed method is compared to the appropriate existing algorithm to determine the performance of the result (Pim Moeskopset. Al. [9]). The cube, correlation coefficient, and ssim parameters are used to examine the proposed work.

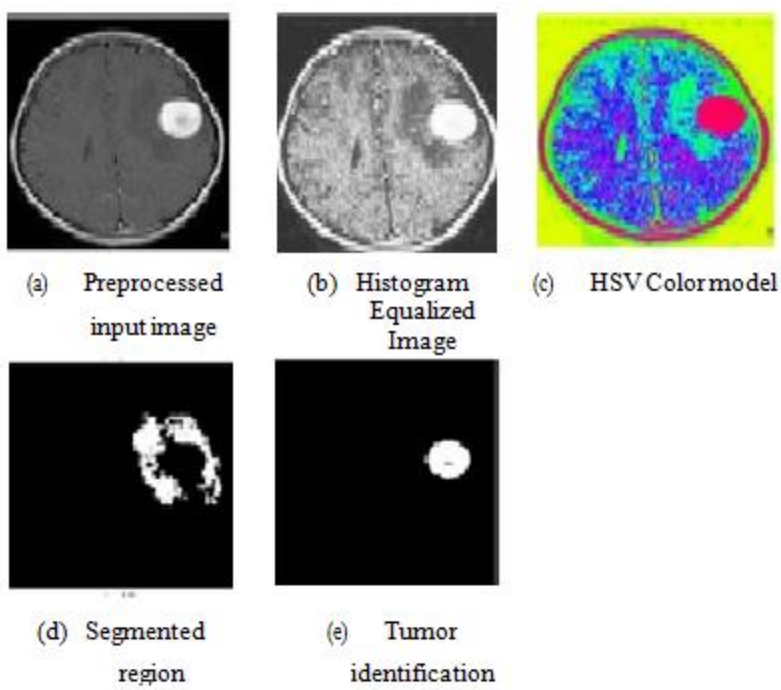

Fig 2. Segmentation process steps

To distinguish the tissue culture target region from the brain image, the improved k-means segmentation method is applied. Finally, the improved method is compared to the current algorithm. The results show that tissue cultures can be identified in the brain image with great accuracy. Findings are categorized based on the detection of a specific site of a brain tumor (Mohammadreza Soltaninejad et al. 2016).

Table1. Shows the comparison of proposed method

	Correlation Coefficient	Dice	SSIM
K-Means	0.02132	1.12435	1.02134
Improved K-Means	0.18723	1.15462	1.08122

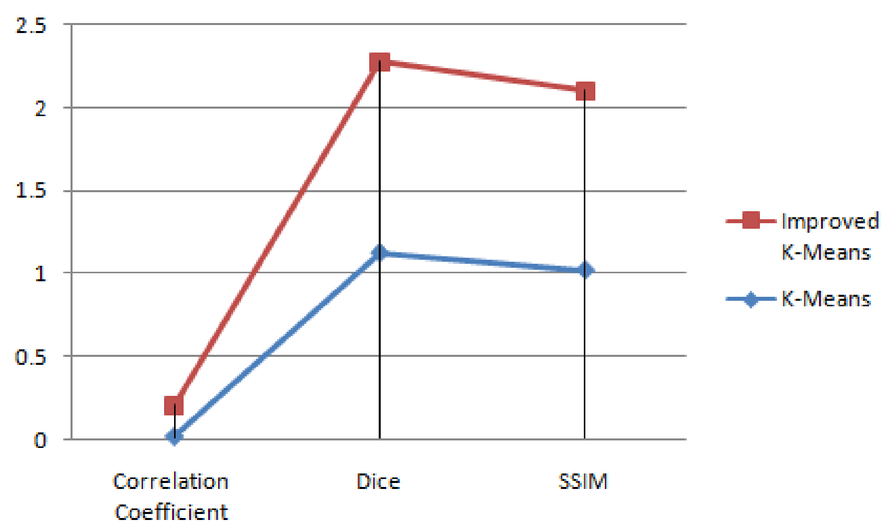

Fig 3. Comparison of proposedmethods with existing.

CONCLUSION

The classic k-means method was used to differentiate the region of interest from the background image. Our suggested approach clearly depicts normal & abnormal brain tissue, which aids in the identification of brain diseases by clinical professionals. This changed k indicates that the brain tumour was successfully segmented from the MRI image. As a result, the proposed approach may identify tumours considerably more rapidly and precisely then manual inspection. Comparing the proposed technique to the present technique and achieving a higher degree of precision demonstrates that the methodology created will be highly beneficial to humanity.

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