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Image Segmentation for Brain Tumor Detection using Fuzzy Clusturing Morphology

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Abstract

Brain Tumour is an uncontrolled distribution of brain tissue. This paper recommended various systems of cerebral tumor identification which have been suggested in order to distinguish between the tumor region inside the head. The majority of studies have been performed in countries due to this, the number of people who have brain tumours is identified and the visual image is examined by a specialist and the detection of brain tumors. The visual image is created. This detection method avoids the precise determination of tumor stage and scale. In order to prevent this, this research project uses c-means, c-medium-flooded (C-means), c-means combined with c-means (KIFCM), and k-MEan-modeled with morphology (MKM) operations. In addition, the optimal test time is reduced. The tumor and its true position and size should be separated from the image at the end of the procedure. The tumor mechanism is based on the number of cluster-based region calculations. Some morphological operation is used to isolate artifacts and minimize noise. Here the volume limit is increased, and noise from the image is expelled. More accurate results were included in the morphological activity option. The area of control was calculated here. Researchers have measured the following parameters in order to test the tests for their accuracy: peak signal to noise ratio (PSNR), mean squared error (MES), root mean carry error (RMSE) and minimum execution.

Keywords**:** *Fuzzy c-mean, K-mean integrated with fuzzy c- mean morphology.*

1. Introduction

The Core part of the human body is the brain. The body is very fragile, spongy and flexible. There are a lot of cells in the brain. Each cell has a function of its own. Brain cells expand and break into another cell to function properly. But these cell growths continue to grow and lose control of them many times. This causes a tumor to develop. Two major tumor types exist: the cancer and the benign tumors. Two types of tumors are again primary, and start in the brain, and secondary and spread tumors are secondary. Cancer tumors are primary.

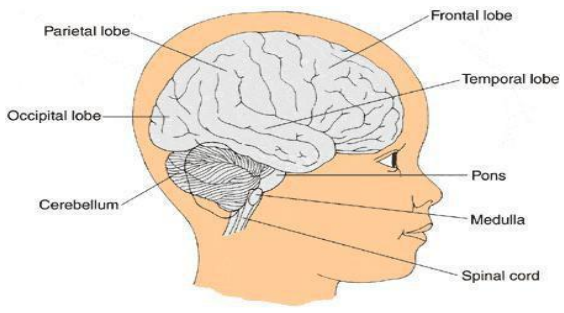

Figure 1: Structural View of the Brain

Depleting factors such as tumor size, scale, location, and degree, including age, health history depend on the manifestations of brain tumour. Clear evidence of headaches, fatigue, numbness, vomiting, or convulsions of a brain tumor. Mental tumor signs are affected by part of the brain tumor and the valuable structure it affect. For example, a brain tumor near the optic nerve may lead to vision problem. The ability to concentrate and reason could be impaired by a tumor before the mind. Any tumor, which is significantly large, may cause many symptoms due to the pressure of the mass. The national brain tumor contains different kinds of brain tumors. Gliomas are the main brain tumors. Roughly 33% of all important glial cell brain tumors are organized.

Brain Tumors Imaging Techniques: In treatment, the MRI scan is better than the CT scan. The body functions are not affected because it contains no radiation. This is based on the appealing environment and radio waves[1]. X-ray: (MRI) is a medical imaging method that uses a non-obtrusive radiation medicine tool to image life processes and, consequently, clinical procedures in the body in both safety and infection. X-rays (Magnetic Resonance Imaging). MRI scanners are used for framing

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body images using strong attractive fields, radio waves and field angles.

CT Scan: a CT scan, also called X-ray CT scan, is used by PC to produce cross-sectional (tomographic) pictures of explicit zones from scanned pictures by using computer-prepared mixes of numerous X-ray frames taken from various edges. The image is viewed without cutting inside.

In the present way of life, many lives have been affected and destroyed by the tumor, which is one of the most widely known diseases in the brain. Approximate diagnosis of brain tumors is possible for more than 126000 people around the world every year, and the average death rate is around 97,000 annual according to the International Agency for Cancer Research (IARC),[1]. "A brain tumor is an abnormal brain cell development that could be cancerous or non-cancerous (benign)." One of the major causes of cancer cell death is a brain tumor. There are two main types of neuropathy. These include the development of primary cancer cells, during which tumor progression starts in the brain itself. The rare variability in brain tumor disorder is the principal growth of cells. brain tumors can grow at any age, but are most common in children 3-12 years of age and 55-65 years of age. Secondary brain cells spread out from another body and reach mind cells, which are called metastasis, to infect them.

The paper is contrasted to "fuzzy c-mean (FCM), k-mean combines with fuzzy c-mean (KIFCM) and modified k-mean operations with morphology (MKM)"

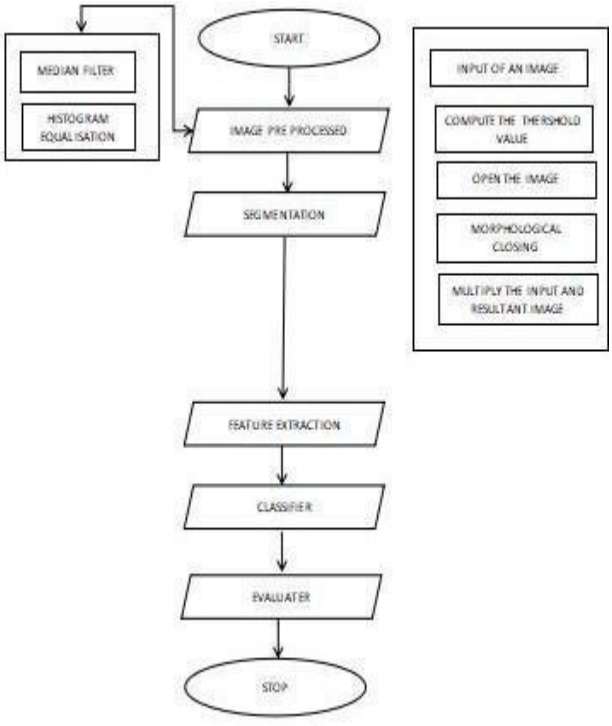

Figure 2: Block Diagram

Grey scale conversion: The RGB image conversion is done by using the rgb2gray (image) function. Red, Green, Blue offers computer complexity and still does not guarantee a better result. For image pre-processing, only grayscale images are favored

Pre-Processing of MRI Image: The pre-processing of MRI images is the first stage in the analysis of images which improves image quality and reduces noise techniques. The importance of these approaches was underlined in this work in relation to the classification and segmentation of brain images by Magnetic Resonance (MR). The test results for the preprocessing segmentation and removal of feature extraction techniques are analyzed in terms of segmentation efficiency.[2]

Low Pass Filter: Initially a low-pass filter is used for smoothening processes. The simplest low-pass filter measures the average pixel and eight immediate neighbors. The process is repeated for each pixel in the image. The lowest pass filter is also referred to as "blurring" or "smoothing" filter.

Median Filters: The median filter is used for the removal of the noise signal. By removing each element, the Medium filter passes through the signal. The median filter conserves the edges of a non-linear filter.

Image Segmentations: Segmented images are usually used in digital recognition of objects and boundaries (line, curve etc.). More precisely, the segmentation of the image is the process by which each pixel in the image has a label with pixels on the same label.

Thresholding Method: The threshold method substitutes each pixel in a black pixel image if the intensity of the I(i, j) image is below the static constant T or white pixel if the intensity of the image is greater than the constant.[3]

Morphological Technique: It is used to evaluate an image with a small form or prototype called the structuring part. The structuring factor is located everywhere in the image and is compared with the pixel neighborhood. Many operations are checking if the product "suits" in the neighborhood, others are investigating if it enters the neighborhood or intersects. **Watershed Segmentation:** The segmentation of waterbasins is a gradient-based segmenting technique. The segmentation of waterbasins addresses a range of image segmentation issues. It can be used for images with higher intensity. Segmentation of the watershed is caused by segmentation. Segmenting the image [5] is the method for splitting a digital picture into multiple segments (sets of pixels, also known as Super pixels). To monitor the segmentation, a watershed is used. The division of images is used to locate in the picture points and frontiers (lines, curves, etc.). The image segmentation of an image becomes all the more obvious, so that some visual characters are shared by pixels with similar labels.

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2. Proposed Methodology

Classified as thresholding, regional development, clustering, edge detection and other processes etc are key image treatment techniques for the segmentation of brain MRI images. The following sections describe all these approaches and discuss other extraordinary processes.

Thresholding based techniques: The bulk and the oldest methods for the segmentation of the picture are thresholds. The segmentation of the image depends upon the gray pixel level for thresholding approach. The histogram of the picture is composed of peaks and valleys in each area. A default value for the valley between the peacocks[4]. The histogram threshold method relies on comparisons are made with a conception of identification of tumor that divides the image into two parts and histograms and the crop technique is used for evaluating the correct physics of the brain tumor. The technique for thresholding relies on the raw pixel data from the neighborhood. It helps to remove the basic form of an image. Nonetheless, as an initial step in the grouping process, threshold is frequently used. The theory restricts the development of only two groups and does not work if it is opposed with structures that need specific boundaries [6].

Region developing based strategies: The images are distributed using the nearest pixel of the same form (surface, intensity levels, homogeneity or sharpness). During this process The selection starts with some fixed parameters for a seed point (pixel). In the same way, the nearby pixels are constantly attached to the seed depending on the homogeneity criteria. This approach is simple, so that pixels that possess similar properties can effectively isolate in large form. As the spatial relation of pixels is a basis of this technique, the segmented output is necessary to improve compared with the histogram threshold program. Since regional development takes place through local convergence, various image regions are combined into one region with similar criteria. In the process of separation, the region is separated from sub-areas which do not follow such homogeneity requirements. Splitting and blending can be used, and their use is largely dependent on the chosen model for homogeneity. The seeded area that develops is regulated by several intial seeds using the tuning of homogeneity parameters. If the number of regions is known and used to determine the correct parameters of edge detection.

Clustering Based Methods: The grouping approach organizes objects into groups based on certain traits, attributes and features. A cluster consists of similar groups of objects. Thus. Two kinds of clusters are open, controlled and unattended. Cluster parameters are decided by the user in supervised form clustering. The cluster parameters are selected in an unattended manner according to the clustering process itself.

1) **K-Means Clustering**: K-Means Clustering of the n observations to the cluster, in which each pixel belongs to the cluster in a manner that minimizes the objective function of the cluster's number. Beginning from the initial centers of the K cluster, the observation is reassigned to the cluster based on its similarity with its cluster centre. Automation of brain tumor identification and segmentation in the MRI image is a very difficult task because of high levels of gray similarity in the picture. T. U. and S. Paul. K. Bandhyopadhyay[7] has launched a fully mechanized2-advance brain MRI framing segmentation process. The first step is the skull stripping by producing a skull mask in the image of the MRI and the second step is to divide the image into grays, whites and tumors and then into broa, by means of a two-level granularity-oriented grid calculation, combined with the limitation process in relation to standard neighborhood divergence.

2) Fuzzy C-Means Clustering: Fuzzy clusters of the C-Means are an approach to clustering data, with each data point belonging to a cluster of membership. Fuzzy C-means divides n vectors into c-fuzzy groups and seeks a cluster core in each group so that the cost function of difference can be minimized.

Fuzzy Based Methods: Fuzzy logic is a collection of mathematical principles based on classical binary logic for representing information. For fuzzy structures for the segmentation of brain tumors, strategies can be built for the analysis of intelligent human behaviour. Dunn suggested segmenting the image to the cluster algorithm of the c-means fuzzy (FCM). FCM has been applied and developed for brain segmentation by several researchers. Arakeri et al.[8] suggested a modified version of the MFCM to resolve the strength in homogeneities in FCM. Precision is one of the important factors that prefer computer techniques for brain image segmentation applications. MFCM is used to segment the tumor approximate image and provides further image data.

Rajendran suggested the use of c-means clustering for the segmentation of brain tumors in MR images[9]. Rajendran proposed FCM algorithm does not handle substantial image properties, which contributes to a high sensitivity to noise.A new clustering algorithm called PCM has been introduced to resolve this weakness. A possible membership, which specifically influences clustering precision, is highly sensitive to the choice of additional Parameters of PCM.

The objective function of PCM and FCM was merged into a new objective function in order to overcome the limitation of the original PCM algorithm, and in some special situations where Xuan ji et al adopted some acceptable parameters, the PFCM can be interpreted as PCM and FCM respectively. Pal et al.[9] The proposed PCFM EPFCM method and distance metric, including membership, is modified to overcome noise effect in brain medical MRI images, both local spatial neighborhood semi-local data.

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3. Results and Discussion

This section describes the implications of the proposed Image segmentation procedure, achieved by the use of a true DICOM image of the MRI brain. The whole system was made using the MATLAB program. DICOM is used to calculate precision and accurate interpretation according to its outputs and outcomes.

True positive [TP]: The percentage of photographs with brain tumors arising from a total number of images. True negative [TN]: The resulting number of images does not include brain tumors by total image count. False positive [FP]: The number of images by the total number of images does not identify the positive tumor. False negativity [FN]: The number of images does not identify the negative tumor, but the total number of pictures suggests that the tumor is present.[10]

Accuracy: [TP+TN]/[TP+TN+FP+FN]

Precision: [TP]/[FP+TP]

Recall: [TP]/[TP+FP]

Table 1: Performance characters of KM, KIFCM, MKM

Methods	Tp	Tn	Fp	Fn	Accuracy	Precision	Recall
KM	85.6	0	1	10.3	85.6%	100%	85.6 %
KIFCM	89.8	0	0	8.3	89.8%	100%	89.8 %
MKM	94.6	0	2	6.8	94.6%	100%	94.6 %

Above Table 1 show the performance comparison between the given five tested techniques has been achieved after processing entire row of each column.

Table 2: Performance characters of PSNR, RMSE, MSE

Method	PSNR	RMSE	MSE
KM	23.1667	104.258	0.127
KIFCM	30.1798	109.357	0.417
MKM	33.1987	125.498	0.698

Above Table 2 show the performance comparison between the PSNR, RMSE and MKM for different MRI images.

4. Future Work

Focus on different types of tumor sensing may be taken in other parts of the body, such as the lung, stomach and other organs. The tumor detection will improve the accuracy and complexity of the algorithms. For future it may also be possible to implement the proposed approach in the 3D image and to measure the tumor volume.

5. Conclusion

This modified morphology K-mean (MKM) method shows better results compared to four other methods such as KM, MKM & KIFCM. The method proposed shows the accurate result of the tumor area calculation based on the morphological zone calculation procedure. The most important part of the proposed work is accurate area measurement. Try to remove the limitation of the previous method in this proposed method. The exact location of the tumor is not determined by previous methods.

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Biography

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