DETECTION AND SEGMENTATION OF BRAIN TUMOR FROM MRI IMAGES

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Abstract**—** MRI Imaging plays a vital part in brain tumor for diagnosis, analysis and treatment planning. It is useful to doctor for determine the former steps of brain tumor. Brain tumor detections are using MRI images is a most challenging task, because of the complex structure of the brain. Brain tumor is a strange development of cell of brain. MRI images offer better contrast concern of different delicate tissues of human body. MRI Image gives preferred outcomes over CT, Ultrasound, and X-ray. In this paper we propose image segmentation with k-means and fuzzy c-means algorithm. The experiment is performed using MRI brain dataset. The evaluation result shows that the fuzzy c-means algorithm outperforms k-means algorithm.

Keywords**—** *Brain Tumor (BT), MRI-Images, CT Scan, IP, X-Ray, K-means, Fuzzy C-Means*

I. INTRODUCTION

Human body is comprised of a different types of cells. Brain is a highly specific and delicate organ of human body. Brain tumor is an exceptionally harmful disease for human being. The brain tumor is intracranial mass made up by abnormal growth of tissue in the brain or around the brain.

Brain tumor can be identified by amiable or dangerous type. The considerate being non-cancerous and threatening is cancerous. Malignant tumor is distinguish into two sorts; primary and secondary tumor, benign tumor is less destructive than malignant. The malignant tumor it spread quickly entering different tissues of the brain and therefore, worsening condition patients are loosed. Brain tumor detection is extremely challenging issue because of complex structure of brain [7].

Brain tumor diagnosis is very troublesome as a result of differing shape, size, area and appearance of tumor in brain. To detect Brain Tumor is hard in starting stage since it cannot locate the exact measurement of tumor. Be that as it may, once it gets identified the brain tumor it provides for begin the best possible treatment and it might be curable. And therefore, the treatment depends on tumor like; surgery, chemotherapy, and radiotherapy.

PC algorithm for the depiction of anatomical structures and different region of interest are a key segment in helping and automating particular radiological tasks. These algorithm, called image segmentation algorithm, plays a crucial part in various biomedical imaging applications, for example, investigation of anatomical structure, treatment planning, partial volume correction of functional imaging information, the measurement of tissue volumes, diagnosis, localization of pathology, and PC integrated surgery. Segmentation of brain tumor considers the separation of tumor tissues(tumor, edema and necrosis) from ordinary brain tissues: gray matter(GM),white matter(WM) and cerebrospinal fluid (CSF).Brain tissues segmentation particularly tumor and edema, is a intricate task as a result of artifacts in tumor, complex shape, heterogeneous intensity distribution and variability of the position of tumor. Since brain tumor division has extraordinary effect on monitoring, diagnosis, treatment planning for patients, and clinical trials [8].

Brain tumor is one of the main sources of death among individuals. It is evidence that the shot of survival can be expanded if the tumor is identified effectively at its initial stage. As a rule, the doctor gives the treatment for the strokes instead of the treatment for the tumor. In this manner, location of the tumor is fundamental for the treatment. The lifetime of the individual who influenced by the mind tumor will increment in the event that it is recognized early. MRI is a noninvasive and great delicate tissue differentiate imaging methodology, which gives important data about shape [10].

There are numerous division procedures which can be comprehensively utilized, for example, histogram based strategies, edge-based techniques, manufactured neural system based division techniques, physical model based methodologies, region based techniques (area part, developing, and combining), and clustering strategies (Fuzzy - implies grouping, K-implies grouping, Mean Shift, and Expectation Maximization).Our primary focus is on the procedures which utilize image segmentation to identify brain tumor [8][9].

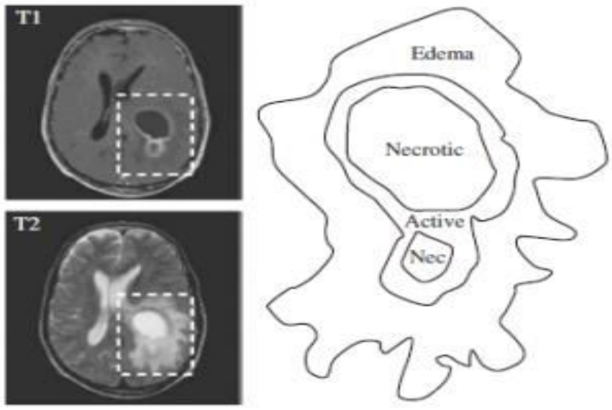

Fig. 1. Labeled example of a brain tumor describing the importance of the various modalities).

II. LITERATURE SURVEY

Tuhin Utsab Paul [1], Detection and segmentation of brain tumors in Magnetic Resonance Images (MRI) is an important but very time-consuming task that required to be completed manually by medical experts. Automation of this process is a challenging task due to the occurrence of the high degree of intensity and textural similarity between normal areas and tumor areas in Brain MRI images. In this paper we propose a fully automated two step segmentation process of brain MRI images. Firstly, the scull is stripped from the MRI images by generating a scull mask from the original MRI image.. Finally, the length and breadth of the tumor is assessed.

Sudipta Roy [2], in this work a fully automatic algorithm to detect brain tumors by using symmetry analysis is proposed. Here we detect the tumor, segment the tumor and calculate the area of the tumor. The quantitative analysis of MRI brain tumor allows obtaining useful key indicators of disease progression. The complex problem of segmenting tumor in MRI can be successfully addressed by considering modular and multi-step approaches mimicking the human visual inspection process. The tumor detection is often an essential preliminary phase to solve the segmentation problem successfully. The experiments showed good results also in complex situations. Segmentation of images embraces a significant position in the region of image processing.

Eman Abdel-Maksoud [3], this paper presents an efficient image segmentation approach using K-means clustering technique integrated with Fuzzy C-means algorithm. It is followed by thresholding and level set segmentation stages to provide an accurate brain tumor detection. The proposed technique can get benefits of the K-means clustering for image segmentation in the aspects of minimal computation time. In addition, it can get advantages of the Fuzzy C-means in the aspects of accuracy. The performance of the proposed image segmentation approach was evaluated by comparing it with some state of the art segmentation algorithms in case of accuracy, processing time, and performance.

Asra Aslam [4], Image segmentation is used to separate objects from the background, and thus it has proved to be a powerful tool in bio-medical imaging. In this paper, an Improved Edge Detection algorithm for brain-tumor segmentation is presented. It is based on Sobel edge detection. It combines the Sobel method with image dependent thresholding method, and finds different regions using closed contour algorithm. Finally tumors are extracted from the image using intensity information within the closed contours. The algorithm is implemented in C and its performance is measured objectively as well as subjectively. Simulation results show that the proposed algorithm gives superior performance over conventional segmentation methods.

Dai Junfeng [5], this paper studies several kinds of image segmentation algorithm, and region-growing algorithm and fast level set matching algorithm FM are programmed by VC and verified, there into, the speed of segmentation of region-growing algorithm is fast. It is primarily affected by the identity of gray level of object region, for the inconsistent object region, excessive segmentation and missing segmentation will happen. The fast matching method can easily handle the geometric objects which topological structure is complex or changing, but the evolving curve also easily leak from the boundary, if there are holes in an object which has been segmented, it will not quite separate the interior outline of the object, so, aiming at the characteristics of medical image, an improved fast matching algorithm is presented in this paper.

III. METHODOLOGY

In this section, the proposed working of proposed framework is explained in detail with algorithm. The proposed framework divided into various stages

- Pre-processing Phase
- Feature Extraction Phase
- Segmentation Phase
- Classification Phase

These phases are executed one by one for detection of brain tumor. The pre-processing phase involves various phases such as.

- Normalization
- Skull Stripping
- Median Filtration

After preprocess, extraction of features are performed which includes features like

- Contrast
- Correlation
- Energy
- Homogeneity

After extraction of features, the segmentation of brain images are performed using two popular approaches

- K-Means
- Fuzzy C-Means

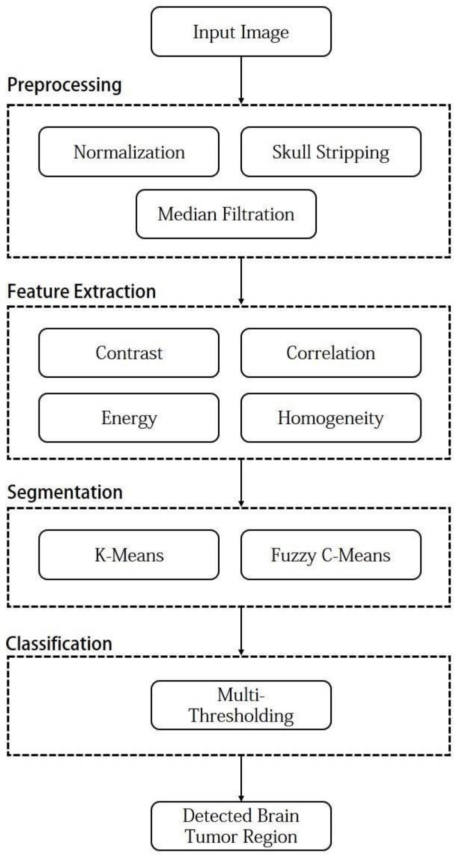

Fig. 2. Shows the system architecture of brain tumor detection

A. Preprocessing

Brain MRI images are taken as input for detection and classification of tumors. The preprocessing step is carried out to remove unwanted noises so that the classifier works well with the given input image without affecting the efficiency. MRI images are firstly converted to the grey scale image so that the intensities are identified. Then removal of other unwanted substance from the image are done which include skull stripping. The skull stripping remove other part of the image except the core brain image object.

B. Image Feature Extraction

Various features of the image are extracted for classification of region of image to have tumor content.

Contrast

Contrast measures the amount of nearby changes in a picture. It mirrors the affectability of the texture in connection to changes in the intensities. It restores the measure of power contrast between a pixel and its neighborhood.

Correlation

This component measures how correlated a pixel is to its neighborhood. It is the measure of dark tone direct conditions in the picture. Feature values go from - 1 to 1, these extremes demonstrating immaculate negative and positive correlation individually.

Homogeneity

Homogeneity calculates the similarity between pixels. A diagonal dark level co-event framework gives homogeneity of 1.

Energy

Energy additionally implies consistency, or angular second moment (ASM). The more homogeneous the picture is, the bigger the value.

C. Segmentation

Segmentation is the method for dividing the source image into different region. These region contain similar intensities images.

IV. RESULT

To evaluate our metrics we have used MATLAB. Image Processing tools are used in our evaluation. We have taken 3 dataset for brain tumor detection. It is present online.

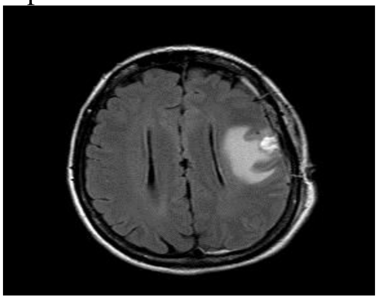

Fig. 3. TUMOR-01.dcm

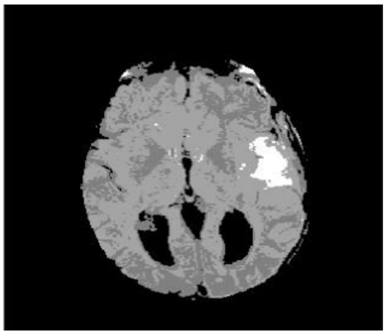

Fig. 4. Shows the output of K-Means with TUMOR-01 dataset

Fig. 5. Shows the output of fuzzy c-means with TUMOR-01 dataset

V. CONCLUSION

From the images in figure 4 and 5 it is clearly visible that the Fuzzy C-Means algorithm outperforms the k-means algorithm in terms of detection of tumor regions. The k-means algorithm unnecessarily selecting the tumor region of brain when compared with the ground truth. The truth is far from the result produced by the K-means algorithm. Fuzzy C-Means algorithm smartly select the tumor region and output only those regions which are relevant. The output of Fuzzy C-Means is the minimal of k-means, because the output produced by k-means contains in the output of fuzzy c-means. Hence fuzzy c-means is better for MRI brain segmentation.

TABLE: I. Presents region of tumor in the brain

Attributes	TUMOR-01	
	K-Means	Fuzzy C-Means
Tumor Area (%)	0.021	0.012
ROI Compression Ratio (CR)	28.46	50.87
ROI CR Bits Per Pixel	0.28	0.15
Non-ROI After Compression (AR)	8.86	8.74
Non-ROI AR Bits Per Pixel	0.90	0.91

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