Brain Tumour Detection Using K-means and Fuzzy C-means Clustering Algorithm

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Abstract-*Image Processing can be used to analyse different medical and MRI images to get the abnormality in the image. This paper proposes an efficient K-means clustering algorithm and Fuzzy C-Means Algorithm under Morphological Image Processing (MIP) and accurate Fast Bounding Box Based Segmentation Method. Medical Image segmentation deals with segmentation of tumour in CT and MR images for improved quality in medical diagnosis.In our paper, this segmentation is carried out using various clustering algorithm for better performance. This enhances the tumour boundaries more and is very fast when compared to many other clustering algorithms. This paper produces the reliable results that are less sensitive to error.*

Keywords-K-means clustering , Fuzzy C-means, Morphological Image Processing, Segmentation, Fast Bounding Box.

I. INTRODUCTION

A brain tumour is an abnormal growth of the cells inside the brain, which can be cancerous or non-cancerous. It is generally caused by abnormal and uncontrolled cell division, which is normally either in the brain itself, or in the cranial nerves, or in the brain envelopes, skull, pituitary and pineal gland, or spread from cancers primarily located on other organs. Brain tumours are of two types: primary and secondary. Primary brain tumour includes any tumour that starts in the brain, which can start from brain cells, the membranes around the brain, nerves, or glands [3]. Here we present tumour detection respective papers are referenced [3],[4].One way to estimate tumour volume is via segmentation.Tumout segmentation is done using K-Means[4] ,Fuzzy C-Means[2][4][5],Fast Bounding Box[7].

II. METHODS

A. K-means clustering:

The k-means method is the simplest methods in unsupervised classification. The clustering algorithms do not require training dada. K-means clustering is an iterative procedure. The k-means clustering algorithm clusters data by iteratively computing a mean intensity for each class and segmenting the image by classifying each pixel in the class with the closest mean[12].In this case, distance is the squared or absolute difference between a pixel and a cluster centre.

B. FuzzyC-Means clustering:

The Fuzzy C-Means algorithm (often abbreviated to FCM) is an iterative algorithm that finds clusters in data and which uses the concept of fuzzy membership. The FCM clustering algorithm was proposed by Bezdek , which was an improved version of k-means algorithm[13]. Instead of assigning a pixel to a single cluster, each pixel will have different membership values on each cluster. It means the algorithm is converging or getting closer to a good separation of pixels into clusters. N is the number of pixels in the image, C is the number of clusters used in the algorithm, and must be decided before execution, μ is the membership table

C. Fast Bounding Box :

Thus an axis-parallel rectangle on the right side that is very dissimilar from its reflection about the axis of symmetry on the left side—i.e., the gray level intensity histograms of the inside of the two rectangles are most dissimilar and the outside of the rectangles are relatively similar.

A novel score function utilize that can identify the region of change with two very rapid searches along the vertical and horizontal direction of the image[4].

III. RELATED WORK

A. K-means clustering:

Step 1: The initial partitions are chosen by getting the R, G, B values of the pixels.

Step 2: Every pixel in the input image is compared against the initial partitions using the Euclidian Distance.

Step 3: Then, the mean in terms of RGB color of all pixels within a given partition is determined .

Step 4:algorithm continues until pixels are no longer changing which partition

Step 5: When there is no more changes in the centroid then execution terminates else repeat step 2 to 4.

B. FuzzyC-Means clustering:

Step 1: Initialize U= $[u_{ij}]$ matrix, $U^{(0)}$

Step 2: At k-step: calculate the centers vectors $C^{(k)}=[c_j]$ with $U^{(k)}$

$$c_j = \frac{\sum_{i=1}^{N} u_{ij}^{m} \cdot x_i}{\sum_{i=1}^{N} u_{ij}^{m}}$$

Step 3: Update $U^{(k)}$, $U^{(k+1)}$

$$u_{ij} = \frac{1}{\sum_{k=1}^{c} \left(\frac{\|x_i - c_j\|}{\|x_i - c_k\|} \right)^{\frac{2}{m-1}}}$$

If $\| U^{(k+1)} - U^{(k)} \| < \varepsilon$ then STOP; otherwise return to step 2

C. Fast Bounding Box :

Step 1: Start the process.

Step 2: Get the MRI scan image input in JPEG format.

Step 3: Check input image in required format goto step 4 ..

Step 4: If image is RGB convert it into gray scale else move to next step.

Step 5: Find the edge of the grayscale image.

Step 6: Calculate the number of white points In the image.

Step 7: Calculate the size of the tumor using the formula.

Step 8: Display the size and stage of tumor.

Step 9: Stop the program.

IV. RESULT AND DISCUSSION

A. K-means clustering:

Figure 1 shows MR image given as input to the pre-processing and K-means algorithmThe K-mean algorithm clusters the image according to some characteristics. Figure is the Output for K-Means algorithm with five clusters. At the fourth cluster the tumour is extracted.

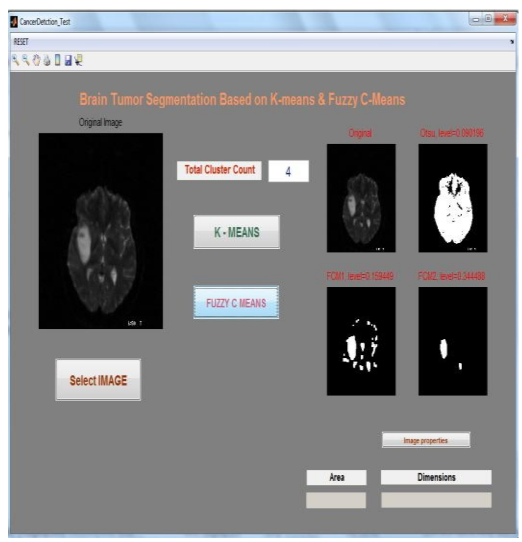

Figure 1: Result for k-means

B. FuzzyC-means clustering:

Figure 2 shows the output image for Fuzzy C-Means. It is mainly developed for the accurate prediction of tumour cells which are not predicted by K-means algorithm. It gives the accurate result for that compared to the K-Means.

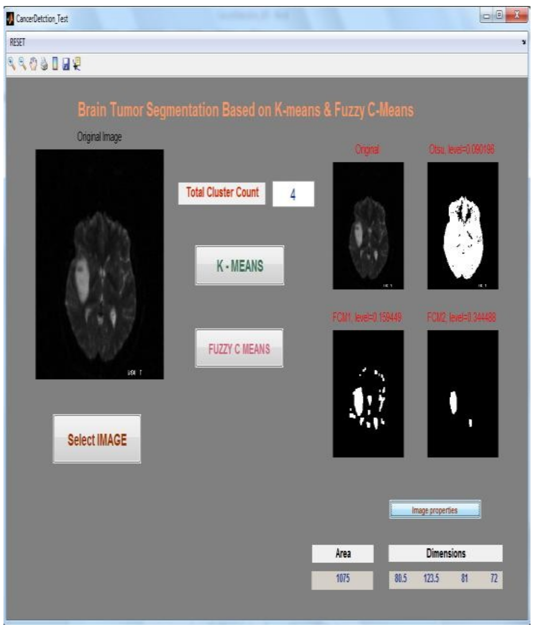

Figure 2: Result for fuzzy c-means clustering

C. FastBounding Box:

In each input MRI slice (axial view), there is a left–right axis of symmetry of the brain. A tumor which is considered an abnormality in the brain, typically perturbs this symmetry.

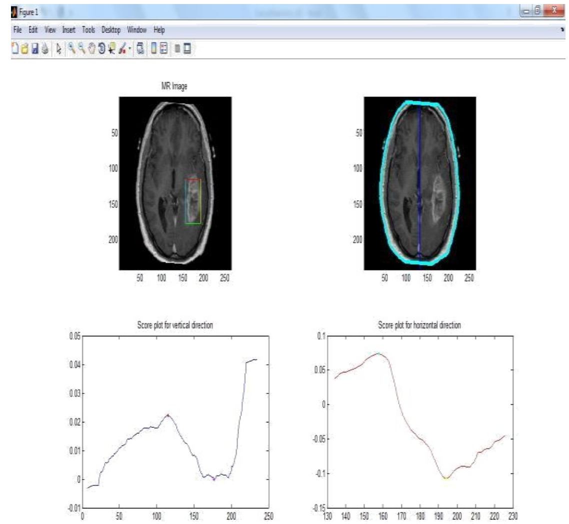

Figure3:Result for fast bound box

V. CONCLUSION AND FUTURE SCOPE

This project work is carried out to detect brain tumor using medical imaging techniques. The main technique used was segmentation which is based on thresholding and morphological operators. Samples of human brains were taken which are scanned by using MRI process and then processed through segmentation methods and both k-means and fuzzy c-means clustering methods, thus giving efficient end result. After the detection of the tumor in given MRI image the area of the tumor is calculated. Proposed method is easy to execute and thus can be managed easily.

FBB is fast segmenting technique that uses symmetry to enclose anomaly by Bounding Box within an axial brain MRI .Novel score uses Bhattacharya Coefficient (BC) to compute local histogram similarity between test and reference images. FBB is fast robust and avoids the variation in the intensities. It can also be implemented in real time.

Future work can be extended for color based segmentation based on 3D images. 3D assessment can be done using 3D slicer.

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