Brain Tumor Segmentation

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ABSTRACT
Tumor is an uncontrolled growth of tissues in any part of the body. Tumors are of different types and they have different characteristics and different treatment. As it is known, brain tumor is inherently serious and life threatening. Brain tumor analysis is done by doctors but its grading gives different conclusion which may vary from one doctor to another. However this method of detection resists the accurate determination of size of tumor. To avoid that, uses computer aided method for segmentation of brain tumor based on the combination of three algorithms. This algorithm allows the segmentation of tumor tissue with accuracy comparable to manual segmentation. It also reduces time analysis. At the end of the process the tumor is extracted for MR image and its exact position and its shape is also determined.

Keywords
Magnetic Resonance Imaging (MRI), Pre-Processing, K-means, Fuzzy c-means, Linde- Buzo- Gray algorithm.

1. INTRODUCTION
Image Segmentation is a fundamental issue in biomedical imaging area. The system aims at studying and comparing segmentation algorithms, based on standard parameters like mean human interaction, area, entropy, peak signal to noise ratio. Our objective is to develop a system incorporating image processing and computer vision techniques for enhancement, segmentation of brain tumor. Our aim is enhancing the current accuracy of diagnostic using industry standard simulation software tool, matlab and dataset. The system is expected to improve the efficiency of brain tumor screening, and possibly reduce health care costs by decreasing for follow-up procedures.

2. RELATED WORK
The existing method is based on the thresholding and region growing. The thresholding method offered the possibility of conducting a simple and fast segmentation but ignored the spatial characteristics. Normally spatial characteristics are important for the tumor detection. In the thresholding based segmentation the image is considered as having only two values either black or white. But in bit map image consists 0 to 255 gray scale values so sometimes it may ignore the tumor cell also; this technique is generally used as first step in the segmentation process. In the case of the region growing based segmentation it needs more user interaction for selection of the seed. Seed is nothing but the Centre of the tumor cells; it may cause intensity in homogeneity problem. This is the main drawbacks of existing system hence this is the proposed method for tumor segmentation.

3. BLOCK DIAGRAM

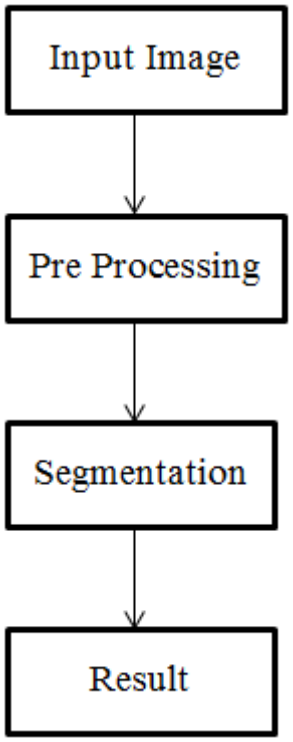

Fig.1. Block Diagram

User need to first select the MRI image. The MRI images which are obtained from the various sources typically have huge size of the image due to which they are highly susceptible to noisy and inconsistent data. Processing low quality data will lead to low quality result. It is required to improve image data by suppressing unwanted distortions and enhance image for further processing. Image Pre-Processing is nothing but normalizing intensity of the image, resizing an image, colour to gray scale conversion and filtering the image from noise. The next step is to apply the image for segmentation.

4. METHODS
4.1 K-means Clustering [5][6][7]
K-means is one of the unsupervised learning algorithms for cluster. In the K-means algorithm initially the number of cluster k has to be defined. Then k-cluster centre are chosen randomly. The distance between the each pixel to each cluster centres are calculated. Single pixel is compared to all cluster canters using distance formula. The pixel is moved to the particular cluster which has shortest distance among all. Then

the centroid is re-estimated. The process continuous until the centre converges.

4.1.1 K-means Algorithm

- Give the number of cluster value as k.
- Randomly choose the k cluster centres.
- Calculate the centre of the cluster.
- Calculate the distance between each pixel to each cluster centre.
- If distance is near to the centre then move to that cluster.
- Otherwise move to the next cluster.
- Re-estimate the centre.
- Repeat the process until the centre doesn't move.

4.1.2 Output of K-means Clustering

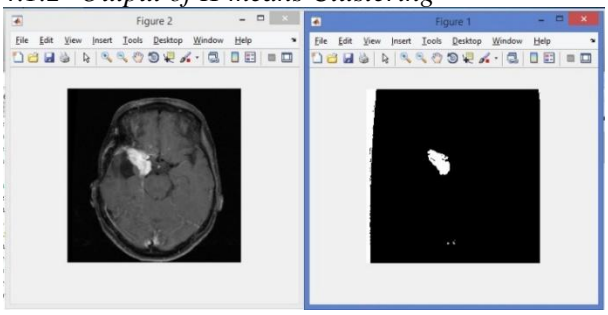

Fig.2. Output of K-means Clustering

4.2 Fuzzy c-mean Clustering [5][6][7]

In fuzzy c-mean the data has to be processed by giving the partial membership value to each pixel in the image. The membership value of the fuzzy set is ranges from 0 to 1. In fuzzy clustering basically member of one fuzzy set can also be member of other fuzzy sets in the same image. These are the three basic features involved in characterization by member function. The core is the fully member of the fuzzy set. The support is non-membership value of the set and boundary is the partial membership with the value between 0 and 1.

4.2.1 Fuzzy c-mean Algorithm

- Randomly select the k cluster centre.
- Calculate the fuzzy membership using distance formula.
- Calculate the fuzzy centre using formula.
- Repeat steps 2 and 3 until minimum value is achieved.

4.2.2 Output of Fuzzy c-mean

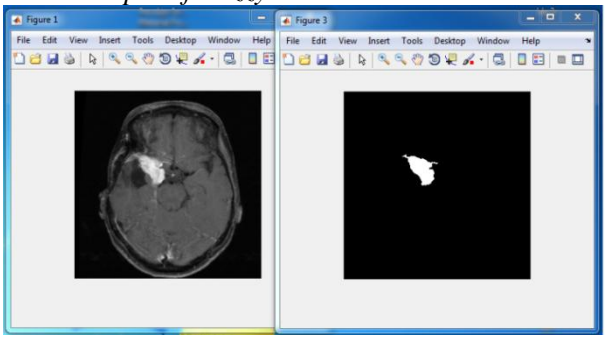

Fig.3. Output of Fuzzy c-means

4.3 Linde Buzo Gray Algorithm (Vector Quantization) [8]

The LBG algorithm is an iterative algorithm. Two dimensional vector space are been created. It requires an initial codebook to start with. Codebook is generated using a training set of images. The training vector space is created and then the centroid is obtained. The centroid is considered as the first code vector. Now, constant errors are added to the code vector and two new vectors are created. By using Euclidean distance two clusters are obtained in first iteration. In the next iteration same procedure is repeated.

4.3.1 LBG Algorithm

- Generate the training vector space, T of the image which contains M training vectors.
- Find centroid c, this centroid is the first code vector.
- Two new vectors are obtained after adding constant error to code vector.
- Find the Euclidian distance of the training vector space with these two vectors.
- Put the training vector in first cluster if the distance between the training vector and the code vector is less else put the training vector in the second cluster.
- Repeat the steps 2 to 5 for every cluster.
- Stop when desired codebook size is obtained.

4.3.2 Output of LBG Algorithm

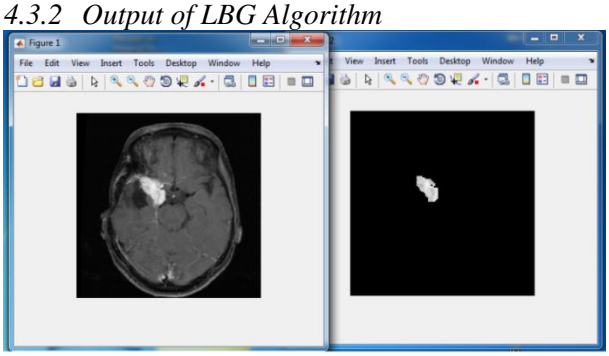

Fig.4. Output of LBG algorithm

5. COMPARISON

Table 1: Comparison of algorithm.

PARAMETER	KMEANS	FUZZY C MEAN	LBG
TIME (approx.)	8.18 sec	9.73 sec	60.22 sec
AREA (approx.)	21.06	906.25	707

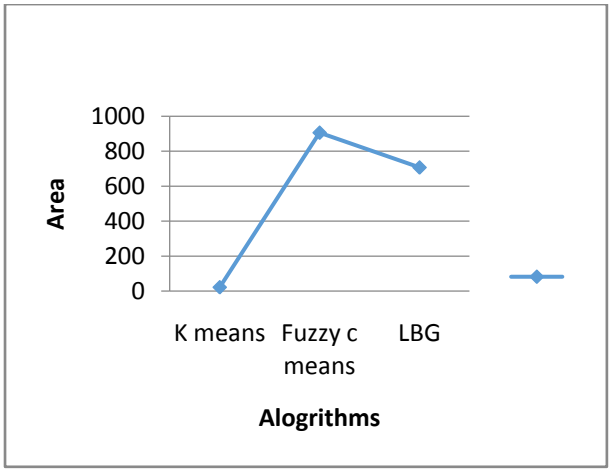

Fig.5.A sample line graph of area comparison

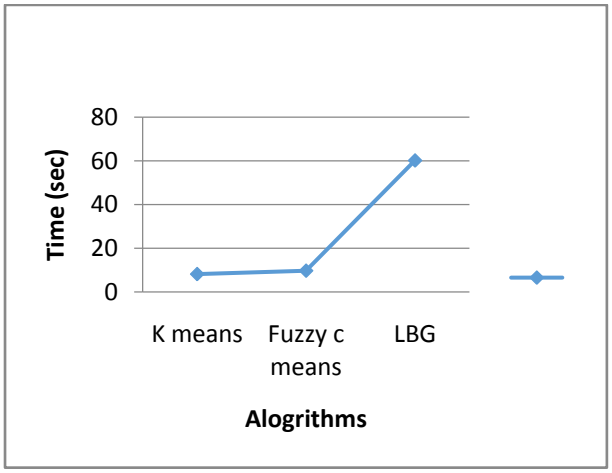

Fig.6. A sample line graph of time comparison

The above mentioned algorithm are implemented and tested on the basis of parameters like area and time for approximately 20 images. As the Fuzzy c means gives the optimum result as it gives the maximum area. The lbg requires the more time to execute then other algorithms. The area segmented by k means is less precise then other algorithm.

6. CONCLUSION

The three algorithms k-means, fuzzy c-mean and lbg algorithm were successfully implemented and also reviewed the techniques of the MRI image enhancement in terms of tumor pixel detection. Comparison of these algorithms are done on the basis of time and area. This paper gives enhanced information about brain tumor detection and segmentation. The future scope of the project is classification of the tumor.

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