International Journal of Engineering Innovation & Research
Volume 2, Issue 5, ISSN: 2277 – 5668

Improved K-Means Algorithm for Identification MR Brain Image Tumor

Prof. Dilip Kumar Gandhi
Assistant Professor
T.I.T. Bhopal, M.P.
Email: dilipgin23@gmail.com

Sunil T. Bhoi
M.Tech. Student
T.I.T. Bhopal, M.P.
Email: sunilbhoi1@gmail.com

Prof. Vikas Gupta
Associate Professor
T.I.T. Bhopal, M.P.

***Abstract* - Now a days there are so many biomedical applications are developed. Magnetic resonance imaging (MRI) is another modern diagnostic imaging technique that produces cross-sectional images of brain. Brain tumors are created by an abnormal and uncontrolled cell division. The MRI tool uses magnetic fields and a sophisticated computer to take high-resolution pictures of brain soft tissues. These images are visually examined by the physician for detection & diagnosis of brain tumor. In this paper an improved fuzzy K-means algorithm for detecting the shape of tumor in brain MR Images is described. This project uses computer aided method for detection of brain tumor and assist to physician for calculate correct shape of tumor. It also reduces the time for analysis.**

***Keywords* – Magnetic Resonance Imaging (MRI), Brain Tumor, Fuzzy C-means, K-means, Clustering.**

I. Introduction

Any type of brain tumor is inherently serious and life-threatening because of its offensive and infiltrative character in the limited space of the intracranial cavity. Normally the anatomy of the Brain can be viewed by the MRI scan. In this paper the MRI scanned image is taken for the entire process. The MRI scan is more comfortable for diagnosis. And a sophisticated computer to take high-resolution pictures of brain soft tissues with tumor. It is not affect the human body. Because it doesn't use any radiation. It is based on the magnetic field and radio waves. The detection of tumor is important for getting proper treatment. The lifetime of the person who affected by the brain tumor will increase if it is detected at current stage. There are various types of algorithm for segmentation were developed for brain tumor detection. In this paper, k-means algorithms is used for segmentation. This algorithm gives the accurate result for tumor segmentation. Normally tumor cells are of two types. They are Mass and Malignant. In this paper we focused on detection of mass tumor detection. The developing platform for the detection is mat lab. Because it is easy to develop and execute. In this proposed method step by step process is done at the end we are detecting the tumor and its shape.

II. Outline of the Work

In proposed method MRI image pre-processing done by wavelet transform, then segmentation using K-means algorithms, Feature extraction done by binarization and finally get tumor area. There are various types of segmentation algorithms are available but they are not give accurate segmentation as K- means algorithms gives. Proposed method is step by step explained as below.

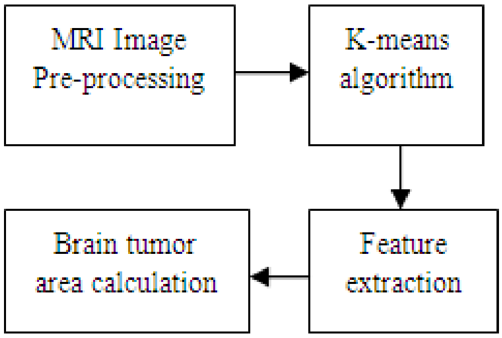

Fig.1. Block Diagram of Proposed Method

III. Methodology

Wavelet transform plays an important role in the image processing technique. In this proposed method image pre-processing done by discrete wavelet transform (DWT) and the high frequency sub bands as well as the input image are interpolated. The estimated high frequency sub bands are being modified by using high frequency sub band. Then all these sub bands are combined to generate a new de-noised image by using inverse DWT (IDWT)[4]. The quantitative and visual results show the superiority of image for image enhancement techniques.

Segmentation is carried out by K-means algorithms. The feature extraction is extracting the cluster which shows the predicted tumor at the end KFCM output. The threshold process is applied on extracted cluster and binary mask is applied over the entire image [8]. This binarization method used for calculate tumor area.

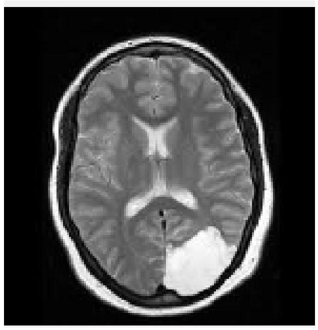

Fig.2. Input Image

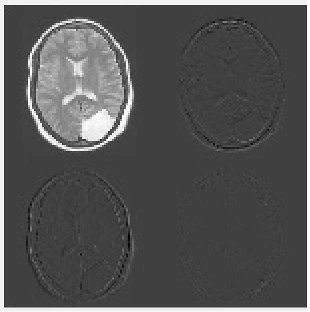

Fig.3. DWT Applied Image

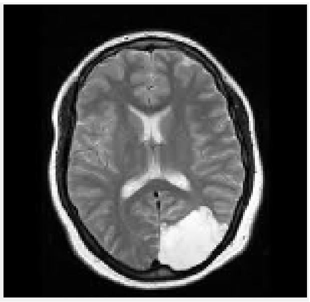

Fig.4. IDWT Image

Fuzzy Clustering

The fuzzy logic is a way to processing the data 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. Fuzzy clustering is basically a multi valued logic that allows intermediate values i.e., member of one Fuzzy set can also be member of other fuzzy sets in the same image. There is no abrupt transition between full membership and non membership. [6],[7]The membership function defines the fuzziness of an image and also to define the information contained in the image. These are three main basic features involved in characterized by membership function. They are support, Boundary. The core is a fully member of the fuzzy set. The support is non membership value of the set and boundary is the intermediate or partial membership with value between 0 and 1

Fuzzy c-means algorithm

The algorithm contain following steps:

1. Initialize M= [Mij] matrix, M(0)
2. At k-step: calculate the centers vectors R (k) = [Rj] with M (k)
3. Update U (k), U (k+l)
4. If || M (k+1)) - M (k) || < δ then STOP, otherwise return to step 2.

K-means Algorithm

K-means algorithm is a popular partition algorithm in cluster analysis is the one of the unsupervised learning algorithm for clusters. Clustering the image is grouping the pixels according to the same characteristics. K-means clustering is an algorithm to group objects based on attributes/features into k number of groups where k is a positive integer. The grouping (clustering) is done by minimizing the Euclidean distance between data and the corresponding cluster centroid. Thus the purpose of k-means clustering is to cluster the data.

$$M = \frac{\sum_{i;c(i)=k} x_i}{N_k}, k = 1, \ldots\ldots\ldots, K.$$

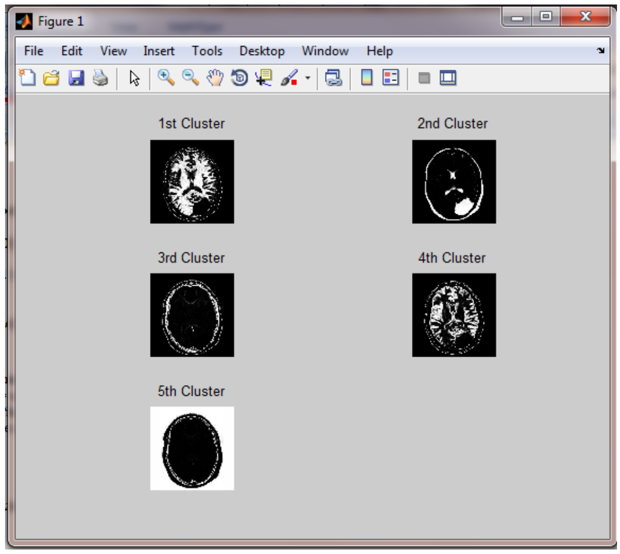

Fig.5. Output after Applying Fuzzy C-means Clustering Algorithm.

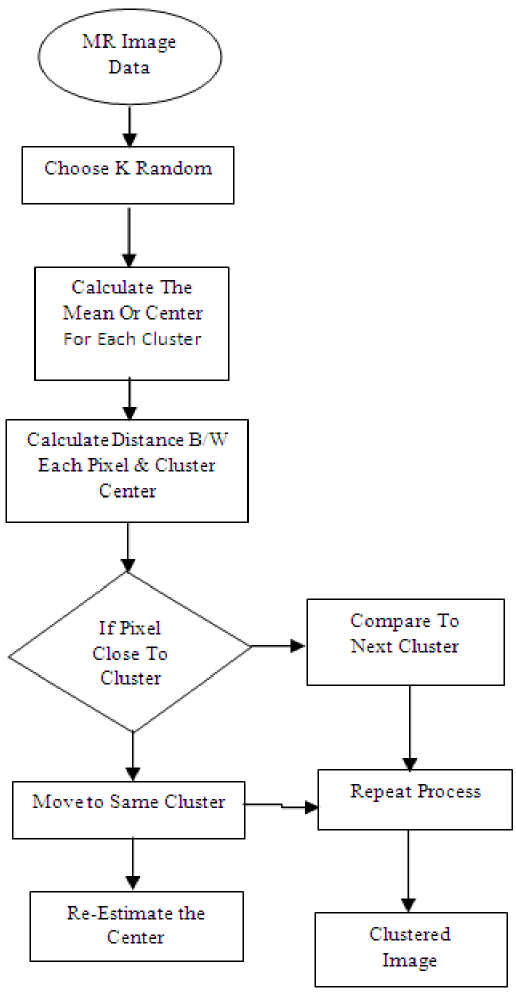

Fig.6. Flow Chart Use for the K-means Clustering Algorithm.

Algorithm steps

1. Give the no of cluster value as k.
2. Randomly choose the k cluster centers
3. Calculate mean or center of the cluster
4. Calculate the distance between each pixel to each cluster center
5. If the distance is near to the center then move to that cluster.
6. Otherwise move to next cluster.
7. Re-estimate the center.

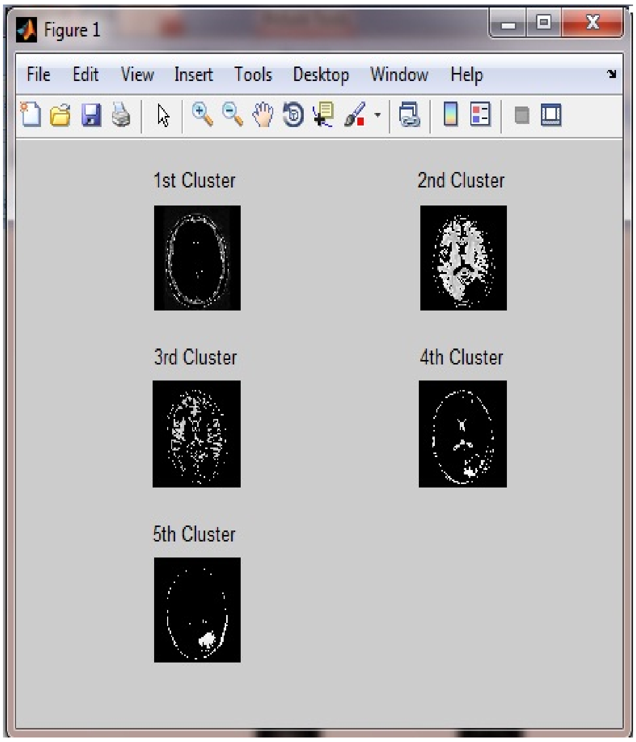

Fig.7. Output after Applying K-means Clustering Algorithm.

Feature Extraction

The feature extraction is extracting the cluster which shows the predicted tumor at the K-means output. The extracted cluster is given to the thresholding process. It applies binary mask over the entire image[5]. It makes the dark pixel become darker and white become brighter. In threshold coding, each transform coefficient is compared with a threshold. If it is less than the threshold value then it is considered as zero. If it is larger than the threshold, it will be considered as one.

$$g(n) = \begin{cases} '0' if\ f(n) \geq T \\ '1' if\ f(n) < T \end{cases}$$

$$I = \sum_{W=0}^{255} \sum_{H=0}^{255} [f(0) + f(1)]$$

Pixels = Width (W) X Height (H) = 256 X 256
f (0) = white pixel (digit 0)
f (1) = black pixel (digit 1)

$$No of\ white pixels, P = \sum_{W=0}^{255} \sum_{H=0}^{255} [f(0)]$$

Where,
P = number of white pixels (width*height)
1 Pixel = 0.264 mm
The area calculation formula is

$$Size of\ tumor, S = \left[\left(\sqrt{P}\right)'0.264\right] mm^2$$

P = no-of white pixels;
W = width; H=height.

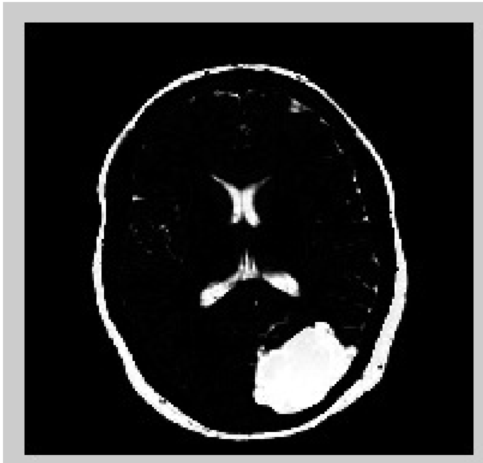

Fig.8. Extracted Tumor Area using Fuzzy C-means

Fig.9. Extracted Tumor Area using K-means

Table I: Parametric Analysis.

Parameters	**K-means algorithm**	**Fuzzy-C-means algorithm**
Processing time	1.709 Sec	10.26Sec
Area in mm^2	14.751	20.64
No. of White pixels	3122	6118

IV. Conclusion

The noise free brain MRI image is given as a input to the k-means and Fuzzy C-means algorithm for accurate tumor shape extracted from it. After that thresholding process & binarization is used for feature extraction. Finally approximate reasoning for calculating tumor area. Comparing both methods K-means take less time and give good result.

FUTURE SCOPE

Future research in MRI segmentation should strive toward improving the accuracy, precision, and computation speed of the segmentation algorithms, while reducing the amount of manual interactions needed. This is particularly important as MR imaging is becoming a routine diagnostic procedure in clinical practice. It is also important that any practical segmentation algorithm should deal with 3D volume segmentation instead of 2D slice.

REFERENCES

[1] Khaled Alsabti , Sanjay Ranka ,and Vineet Singh"*An Efficient K-Means Clustering Algorithm* **"**,Syracuse University, University of Florida, Hitachi America, Ltd.

[2] Michelson Set and John T. Leith, "*Dormancy, Regression and Recurrance: Towards A Unifying Theory Of Tumor Growth Control*",J.Thoer.Biology, 169, pp: 327-328, 1994.

[3] A. Suman Tatiraju,july-2008, "*Image Segmentation using k-means clustering, EM and Nonnalized Cuts*," Symposium of Discrete Algorithms.

[4] J.M. Mendel, R.1. John, F. Liu (2006)," *Type-2 fuzzy logic systems made simple*," IEEE Transactions on Fuzzy Systems 14, 808-821.

[5] H.R. Tizhoosh, G. Krell, and B. Michaelis, (1997) "*On fuzzy enhancement of megavoltage images in radiation therapy*," in: Proceedings of the 6th IEEE International Conference on Fuzzy Systems 3, pp. 1398-1404.

[6] Bezdek, J. C., "*Pattern Recognitio n with Fuzzy Ob- jective Function Algorithms"*, *Plenum Press*, NY, 1981.

[7] J. K. Udupa. L. Wei. S. Samarasekera. Y. Miki. M. A. van Buchem. and R. I. Grossman. "*Multiple sclerosis lesion quantification using fuzzy-connectedness principles*". *IEEE Transactions on Medical Imaging. vol. 16*. 1997. pp. 598-609.

[8] T.Logeswari and M.Karnan, "*An Improved Implementation of Brain Tumor Detection Using Segmentation Based on Hierarchical Self Organizing Map*", *International Journal of Computer Theory and Engineering, Vol. 2, No. 4*, August, 2010 *1793-8201*

AUTHOR'S PROFILE

Prof. Dilip Kumar Gandhi

He is assistant professor at Technocrats Institute of Technology, Bhopal. His qualification is M.Tech. in Telecom Technology. He is having 7 years of experience.

Sunil T. Bhoi

He is a post graduate student at Technocrats Institute of Technology, Bhopal. He has completed B.E. in Electronics and Communication.

Prof. Vikas Gupta

He is associate professor and Head of Department of Electronics and Communication at Technocrats Institute of Technology, Bhopal. His qualification is M.Tech.