

Automated Brain Tumour Detection In MRI Images Using Threshold Based FCM

K.Rajesh babu,V.A.S.Chakravarthy,S.Sandeep reddy,G.Phani kumar,M.Vamsi kumar

Abstract: Brain tumour decreases the life expectancy of the human if not identified at early stages. MRI has been widely used as one of the identification procedures. Image segmentation was important character in analysing medical images. Accompanied by variety of segmentation algorithms, Magnetic Resonance Imaging (MRI) has been widely used as a reliable evaluation procedure. Brain tumour recognition is one of applications that involve an image segmentation technique and pre-processing stage added to increase the recognition accuracy. In this paper, different types of automatic tumour detection technique are included such as FCM, Thresholding and Threshold based fuzzy C-Means segmentation. FCM method works by conveying membership to each data point equivalent to each cluster centre based on distance between the cluster centre and data point. The thresholding is the simplest and widely used method for segmenting the medical images and used for discriminating foreground objects from the background. The Thresholding based FCM is the combination of both features of fuzzy C-Means and thresholding process to avoid drawbacks in that methods. In the threshold based FCM clusters are determined automatically by selecting an adequate threshold. And finally, we can observe as per the performance metrics threshold based FCM perform better than FCM clustering and Threshold algorithms.

Keywords: MRI; Pre-processing; Segmentation; Brain Tumour; fuzzy C-Means; Thresholding; Thresholding based FCM.

1.INTRODUCTION:

A brain tumor happens when uncommon cells form shape in skull. And it has kinds of tumors. They may be malignant tumors and benign tumors. All types of brain tumors may also give symptoms which change upon the part of the brain involved. The therapy of infectious brain tumors is surgery. Its aim is to clear the disease as much as possible without inflicting harm to the other fragments of the brain. While location of some tumors allows for easy and safe removal, other tumors will be located in an area that limits how much tumor can be moved out. Initial treatment avoids difficulties which occur as the tumor gives heaviness on the skull and brain material. There are so many modalities to capture the medical images such as MR, CT, PET etc. Among all the modalities, especially for brain tumor, it is individual from other scanning modalities because it will not use dissipation, and also provides complete pictures of the images of the skull. An MRI is a non-invasive tool, uses an effective magnet and radio waves related to a computer to create remarkably clean and exact cross-sectional photos of the frame. FCM is a smooth. It is a method of clustering wherein separately record fact dismiss has its place to couple of collection. It will include data points to clusters so items in equal clusters are similar as feasible. Li Guo et al. researched about the Fuzzy C-means, obtained an enhanced FCM by incorporating a regularization term to impact membership updating via guidance data. For the sake of practicality, in this paper, we only use GF's standard model to include the guidance information. And only the FCM is used to enhance the basic model. The organization of FCM based thresholding is given. In section I give out the proposed methodology. Section II results followed by discussion and conclusion in section III.

2 METHODOLOGY:

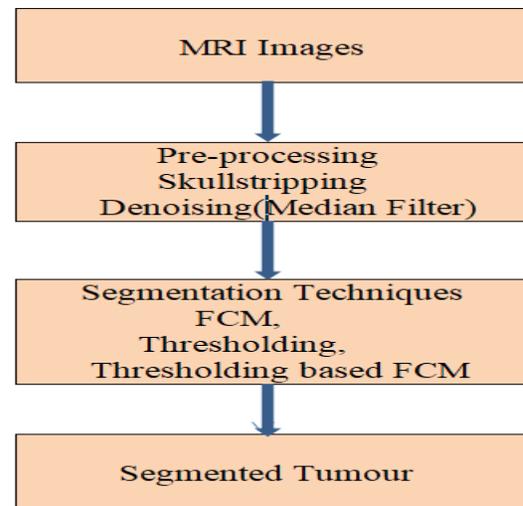


Fig 1. Proposed Methodology

Here in this study, the techniques were executed to cluster of the human brain with tumor. The pictures have the size of 256*256 pixels per line. The images were pre-processed with FCM and Thresholding algorithms first, and then the image was clustered using Thresholding based FCM.

2.1. Pre-processing: It is a common name for operations with photographs at the lowest stage of set of pre-occupation both input and output are images. The purpose of pre-processing is a development of picture records that suppresses unwanted distortions or enhances a few photo features essential for addition processing. For more correct and brain tumor separation outputs a pre-processing step will be applicable to enhance the input MRI before segmentation. The Magnetic Resonance Imaging tumor has excessive power degree than different tumors.

2.2. Fuzzy C-Means (FCM) Clustering Algorithm: This technique is also called as soft clustering. The FCM algorithm sends a data point to belong to all the

clusters with the membership in between 0 and 1. If the data approximate to group centre its membership will be more towards a cluster. The function defines the fuzziness of a picture and to define the information contained in the image. It centred on objective feature, with appreciate to fuzzy attachment, set of cluster centroid. The FCM algorithm enhances with continuous update of fuzzy involvement and set of collection centroid. In FCM the iterative process of moving cluster centres nearer to input values. For minimizing the sum of the least square error function to find the centroids given as

$$O(U, c_i) = \sum_{i=1}^k O_i = \sum_{j=1}^m x \sum_{j=1}^m \mu_{ij}^m d_{ij}^2 \dots\dots(1)$$

Where, μ_{ij} is membership value d_{ij} is the distance between j_{th} information point and i_{th} cluster centre c_i ; k is given as amount of groups; n is integer of information patterns indistinguishable to the conclusions used. In order to reduce the objective purpose O which involves the calculation of resemblance, the community degrees and the cluster centres and provides each information points are updated repeatedly until the perfect converge occurs. It's miles a mathematical device allows in the removal of set of cluster models from tool of data set so as to measure items to homogenous subsets. It allows one picture belongs is high than another cluster, and it aim is to separate a given set of records into certain amount of constellations. It is used for calculating the centres of the clusters, which is scheming histogram then a fixed threshold will convert the data from grey to binary image. In this every information point under to group upto some level which is identified by allocating grade. The goal is to minimize the criterion function, taking into account the similarity of elements and cluster centres. It is more useful for data set that have highly overlapping groups. FCM is easily implemented and has obtained satisfactory results in many applications. It has become an important tool for pattern recognition.

2.3. Thresholding: It is simplest approach of image segmentation. From gray scale image, thresholding can be used to create binary pictures. And simplest thresholding methods replace every pixel in an photograph with a black pixel if the photograph depth $I_{i,j}$ is less than few fixed steady T (that is, $I_{i,j} < T$), depth is greater than constant. It's miles yet effectively, way of partitioning an image into a foreground and history. This image evaluation approach is kind of picture segmentation that isolates gadgets via changing grayscale images into binary images. pics thresholding is most effective in pix with excessive levels of comparison. Threshold method is one of the critical strategies in image segmentation. This technique can be expressed as:

$$T = T[a, b, p(a, b), f(a, b)] \dots\dots(2)$$

Wherein T is threshold value, a, b are synchronizes the threshold fee fact, $p(a, b), f(a, b)$ are the factors the gray level pics pixels. Threshold image $g(a, b)$ can be define:

$$g(a, b) = \begin{cases} 1 & \text{if } g(a, b) > 1 \\ 0 & \text{if } g(a, b) \leq 0 \end{cases} \dots\dots(3)$$

2.4. Thresholding based FCM: In clustering, the involvement function of removed structures for every

pixel at each cluster variation relational to zonal mean values and gradient mean of next to pixels. The direction of distinctions are detailed using hominoid interface. Their subdivision method was applied for division of texture, documentations descriptions and the outcomes have shown that the human collaboration to classification of quality and lessening of noise is segmented images.

The presentation of a changed fuzzy C-manner process to the segmentation problem this data working by allocating integration to every data point equivalent to cluster centre on source of reserve between band and point. Extra data is nearer to cluster centre more close is the associating in direction of particular midpoint.

Clearly, total sum by assigning every data argument be equal to one. Later individually repetition attachment and clusters are efficient through the formula

$$\mu_{ab} = \frac{1}{\sum_{k=1}^c (d_{ij}/d_{ik})} \dots\dots(4)$$

$$v_j = ((\sum_{i=1}^n (\mu_{ab})^n \cdot x_a) / \sum_{i=1}^n (\mu_{ab})^n), \forall j = a, b \dots\dots e \dots(5)$$

Where, n is the number of record values

ϑ_j means b_{th} cluster.

M is fuzziness key $m \in [1, \infty]$

C represents the total clusters.

μ_{ab} combination of a_{th} value and b_{th} point.

d_{ab} Euclidean distance within a_{th} data and b_{th} centre.

Thresholding method was easily and extensively used method for segmenting the medical images. It is suitable for selective forefront objects from related. By selecting an tolerable threshold, the gray scale image can be converted to binary image must comprehend all of the essential data about the location and shape of the objects of interest. During thresholding process assume an article will be blazzing than the background, then specific pixel in an appearance is noticeable as "object" pixels if their value is superior than threshold T else as "background" pictures. It is called as above threshold. Commonly, an object article will give significance of "1" when related convergence is given charge of "0".

Lastly, a second spitting image is generated by converting picture to black and white photograph. Various methods of thresholding are used by the researches out of these methods. Global thresholding and Otsu's thresholding have gained popularity.

3.RESULTS&DISCUSSION:

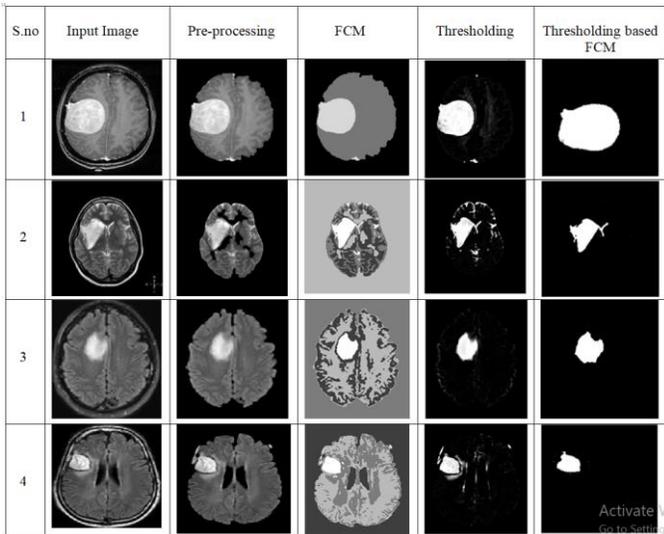


Fig. 2. Results of different segmentation algorithms.

Table 1. Performance matrices of FCM technique

S.NO	SD	ENTROPY	NCC	MI
Image 1	28.92	3.21	0.9924	0.32
Image 2	26.34	2.86	0.9752	0.25
Image 3	29.64	3.64	0.9856	0.36
Image 4	30.28	3.98	0.9871	0.38

Table 2. Performance matrices of Thresholding technique

S.NO	SD	ENTROPY	NCC	MI
Image 1	48.19	5.31	0.5367	0.56
Image 2	46.86	4.82	0.6780	0.48
Image 3	49.36	5.64	0.2951	0.73
Image 4	50.24	5.92	0.2694	0.82

Table 3. Performance matrices of Thresholding based FCM technique

S.NO	SD	ENTROPY	NCC	MI
Image 1	52.92	7.57	0.5277	0.79
Image 2	51.64	7.18	0.6496	0.59
Image 3	52.98	7.79	0.2791	0.83
Image 4	53.28	7.92	0.3062	0.92

In the first stage we have applied preprocessing method for noise removal, cranium stripping and evaluation enhancement on input MR mind snap shots these figure represent the output of pre-processing technique apply on enter MR head metaphors. Earlier pre-processing we achieved tumor segmentation by means of by means of advanced fuzzy C-way collecting, threshold algorithm, Thresholding based FCM process. Figures represent the outputs of tumor segmentation by using the FCM method and Threshold algorithm severally. From the figures, the preprocessing images of brain which is removed noise, skull stripping and contrast enhancement. After that, FCM images will assign the facts ideas for collections so then gadgets in same cluster are comparable as viable, whilst items belonging to

excetional constellations are different as probable. They recognized by comparison methods. These will contain distance, connectivity, depth. Extraordinary similarities might also be chosen based totally on the data. After that, in the thresholding algorithm is better FCM clustering. In thresholding algorithm, PSNR value is 15.6642, MSE value is 30.2246, NCC value is 0.5367, Dicecoefficient value is $4.7724e-10$. So, except the value of Dicecoefficient all the other values are lesser than the FCM clustering. At last, in the Thresholding based FCM algorithm is much more better than the FCM and Thresholding algorithm. In the Thresholding based FCM algorithm the PSNR value is 15.6224, MSE value is 30.4717, NCC value is 0.5227, Dicecoefficient value is $4.7724e-10$. Among the FCM clustering and Thresholding algorithm these values are less

4.CONCLUSION

Segmentation has an important aspect in medical images. In the medical diagnosis field, MRI is the greater powerful appearance model and recycled photograph inspection of brain tumour. As compared with CT scan in all aspects, the MRI scan is easier for the identification of the tissues. In this paper, image segmentation was performed by using Fuzz C Means, thresholding and FCM based thresholding techniques on MRI images with the intent for identification of brain tumours. The authors compared the performance between FCM with thresholding and without thresholding. It is identified from the performance metrics, thresholding-based segmentation provides the better performance in all aspects as compared with the other two techniques. In short, the thresholding-based segmentation technique being the most effective approach to detect the tumour from MRI image automatically without loss of information.

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