International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 08
July 2017

Mri Brain Images Tumor Detection and Feature Extraction Using Clustering and Morphology

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Abstract— *Segmentation refers to classification of an image into different regions. Eventually days medical field is to an extraordinary degree rely upon image segmentation process. This paper aims to segment MRI image using clustering and morphology technique to detect tumor and after that extracting static components of the tumor area. Brain tumor is very hurtful infection. It is demonstrate that the probability of survival can be broadened if tumor is identified or recognized effectively. So an effective diagnosis and detection of brain tumor is very important for the treatment. In this manner we need a more productive tumor detection method with some favored properties such as minimum client interaction, quick computation and accurate outcomes. In this paper an efficient and capable segmentation method is used for tumor detection and feature extraction of brain MRI images.*

Keywords- brain tumor; segmentation; feature extraction; k-mean clustering; MRI images.

1. INTRODUCTION

The Uncontrollable development of irregular cell in a brain tissue is called brain tumor. It is very dangerous, destructive and unsafe disease. In medical imaging, it is very crucial to recognize the correct domain of tumor and its sorts. [7] Tumor can be furthermore separated into two categories in light of the kind of tissue... first is non-cancerous tumor (benign) and second is cancerous (malignant) tumor. There are likewise four grades of tumor that are grade 1, grade 2, grade 3, and grade 4. Grade 1 and 2 type cells are created steadily also called poor grade tumors. Grade 3 and 4 are called high grade tumors which develop very fast and grow quick also called abnormal or irregular cells.

Benign (non-cancerous) brain tumor this one is exceptionally direct creating tumors which causes potentially damaging weight but does not spread into any other part of body. It does not contain any cancer disease cells. Grade 1 and grade 2 are called benign tumor.

Malignant (cancerous) brain tumor this one is quick developing tumor and ready to spread into surrounding brain and whatever other part of the body. This sort of tumor consist cancerous danger cells which can be a threat for life. So malignant brain tumor is an exceptionally unsafe kind of malignancy.

Image segmentation is a method which partition a digital image into multiple homogeneous districts regions, with goal that meaningful and important information can be secure and different analysis can be fulfill. The point of segmentation is to change description of an image to be more meaningful and easier to analyze. [1] The result of image segmentation happens an arrangement of areas or distinctive fragments .Many segmentation algorithms or methods are useful for finding isolated zone. There are different techniques for image segmentation like threshold based method, edge based method, cluster based method, and neural network based techniques. From the various different distinctive techniques a standout amongst the best strategies is clustering method.

Clustering is the process of sorting out the objects into the groups whose members are similar in some way. A cluster is therefore a collection of objects which are similar between them and are dissimilar to the objects belonging to other clusters. Again the clustering method is further divided into various clustering techniques are K-means clustering [8], Fuzzy C-means clustering, Hierarchical clustering, Neural Network clustering, K nearest clustering.

K-mean clustering is a partition based method. It is utilized to partition the image into parts. In this we partition n observations into k clusters. As indicated by this strategy we firstly select k (value) as our cluster centers. [8] Then calculate the distance with each object and each cluster centre. Then assign each object to its closest cluster centre. In k-mean clustering each observation belong to each cluster centre with nearest mean. Morphology technique is numerical based methods for researching geometric structure in binary and gray scale image distinguish important data from irrelevant one.

Feature extraction is a widely used technique in research area. It aims to choose a small set of relevant features from the original one according to the relevant criteria, which leads to higher learning accuracy for classification. Feature classification is a method to identifying to which of a set of

categories a new observation belongs, on the basis of training set of data containing observations.

2. LITRATURE SURVEY

Maksoud et al [6]. Presents an efficient image segmentation approach using k-mean clustering technique integrated with fuzzy c-mean algorithm. The method is followed by thresholding and level set segmentation stage to provide accurate brain tumor detection. Tested algorithms were applied on three different data sets consist of 255MRI images of the brain contain tumor cells. The study eliminated the user interaction, saved time, avoided over-segmentation and under-segmentation and achieved the accuracy.

Malathi and nadirabanu [5] proposed an algorithm for tumor detection based image segmentation of brain MRI images using clustering. They attempted k-mean clustering algorithm for tumor detection. The method consists of three steps: image acquisition, pre-processing and k-mean clustering. K-mean clustering algorithm gave good result but it takes a long time.

Galvan and holvan [4] offered a way in of CNN (convolution neural network) for breaking down into parts using x-ray images. They used CNN as a classifier. CNN get at the details of each image bit of picture and put in order into 2 groups: bone and none bone. They separated both part from each other and note as being different the bone tissue square measure from the x-ray images. Convolution neural network got the best results and took in the importance of bone part, but take a long execution time.

Wilson and Dhas [12] utilized K-means and Fuzzy C-means separately to distinguish the iron in brain SWI. The extraction of the iron locale in the brain is made by K-means and Fuzzy C-means grouping strategy. The SWI is looked for brain utilizing K-means and FCM techniques. The analysis based on Fuzzy C-implies shows that the iron areas are effectively noticeable than the yield of K-means picture. The principle burden of their technique is that they didn't make an incorporation that gets merits of the two techniques and beat the drawbacks of them.

Parisot, et al [9] thought about an alternate approach for recognition, division and portrayal of brain tumors. This method misuses earlier information in the shape of a scanty chart depicting the normal spatial positions of tumor classes. They consolidated a picture based location plot with distinguishing proof of the tumor's relating particular area, which was related with a particular spatial conduct.

Tatiraju and Mehta [11] Introduced image partioning down into parts using K-means into groups, degree in which event is probable greatest degree (unit of measure in printing), and Normalized cuts (NC). They sent in name for the making into parts algorithm to gray-scaled images with changing value of K (number of groups of things). For larger values of K, the breaking down into parts is very common; many clusters come into view as in the images at discrete places. The N-Cuts algorithm gave good results for larger value of K, but it takes a long time.

Anamika Ahirwar [2] proposed a strategy that join district developing and edge recognition strategies for mind MRI image division. They begin with a straightforward district developing calculation which creates an over sectioned picture, after that a complex district combining technique is connected which is fit for taking care of complex picture structures. Edge data is then incorporated to approve. Also, wherever required, rectify district limits. The conclusion demonstrates that the strategy is solid and proficient for MR brain image division.

Funmilola et al. [3] made the Fuzzy K-C means strategy, which conveys a greater amount of Fuzzy C-mean properties than that of K- means. The calculation peruses the picture, decides the emphases, decreases the emphases by separation checker, gets the size of the picture, links the measurement, produces expansive information things with separation estimation, and lessens redundancy when conceivable separation has been accomplished. The creators diminished the cycles by checking the separations as it were. The inconvenience is that the aftereffect of their proposed technique is comparable to the result of the Fuzzy C-implies calculation with the exception of in a few pictures. The season of Fuzzy C-means is more noteworthy than by most extreme 2 s than their proposed technique.

S. Murugavall et.al [10] executes a neuro-fuzzy division system of the MRI information to recognize diverse tissues like WM, GM, CSF and tumor. To recognize brain tumor a neuro-fuzzy based division was actualized. As far as weight vector, the execution time and distinguished tumor pixels they considered the execution of the biomedical picture. At that point look at the comes about with existing strategy, this accomplishes a higher estimation of recognize tumor pixels than whatever other division system. The number of

tumor cells and the execution time will likewise be dissected for weight vector esteem with the diverse separation classifier techniques. This additionally examines the change of development rate of the tumor of a similar patient. A Fuzzy neural system for medicinal picture division is utilized to investigations the tumor by extraction of the elements.

3. PROPOSED METHODOLOGY

1. Read input image.
2. Load the data set of gray scale images.
3. Preprocessing.
4. Convert input image into binary image.
5. Apply k-mean clustering for image segmentation.
6. Apply morphology on segmented cluster.
7. Segment tumor area.
8. Feature extraction of tumor area.

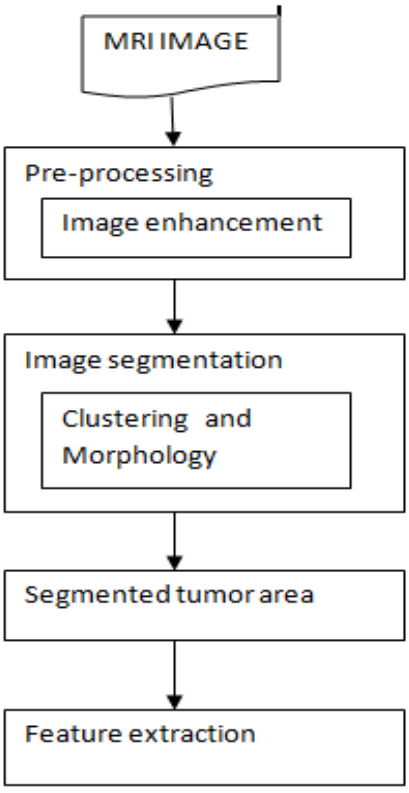


Figure 1: Proposed Methodology Diagram

A proposing framework for tumor detection and classification is developed as shown in figure. The frame work represent pre-processing, image segmentation, feature extraction and classification section. Segmentation and detection of brain tumor is a difficult task now days. Magnetic resonance imager is a device used for diagnosis and detection.

3.1 Pre-processing

In pre- processing unit MRI images is processed and adjusts the intensity value of image, extracting the pixel value and reduces the noise effect. Enhancement is done using CLAHE (Contrast Limited Adaptive Histogram Equalization) technique that improved the quality of image. CLAHE operates on small regions in the image rather than the entire image. Each small region is enhanced. By using this technique sharp field edges Can be maintained by selective enhancement with in the field boundaries.

3.2 Image segmentation

In the second section of processing segmentation is done for accurate tumor detection. We have proposed segmentation of brain MRI images for detection of tumors using clustering and morphology. K-mean clustering is applied for tumor detection. In K-mean clustering n observations is partitioned into K clusters. For remove the over segmentation morphology is applied.

The K-mean algorithm runs through following steps:

1. From the given total observations, set random value of K.
2. Initialize K cluster centre.
3. Assign each object to its closest cluster centre.
4. Partition of observations should be on minimum distance.
5. Move the object in the cluster which it belongs.
6. Update the centre for each cluster.
7. Repeat step 3 and 4 until no changes in each cluster centre.

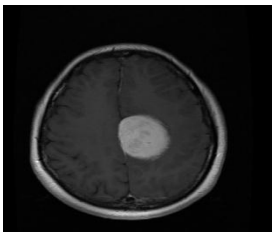
3.3 Feature extraction

In this section feature is extracted of the tumor area. It focuses on to choose a small set of relevant features from the detected area according to the relevant criteria, which leads to higher learning accuracy for classification. These features can improve the detection of tumor and decision accuracy. Various static features like mean, mode,

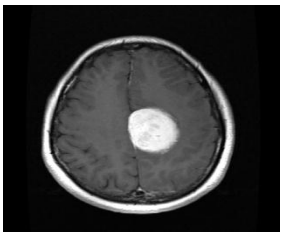
variance and standard deviation are extracted for decision accuracy.

4. RESULTS

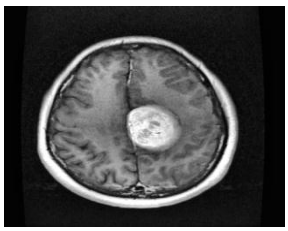
Figure 2 shows the segmentation process of MRI image. Figure A show an original image which we segmented. Figure B and C shows the preprocessing process of an MRI image. In these images firstly we adjust the intensity of an image. Then we enhanced the image. Figure D shows the image after apply K-mean clustering. Cluster shows the tumor portion. But for more accuracy we apply morphology for segmentation tumor. Figure E shows resulted image after apply morphology and tumor area is segmented.



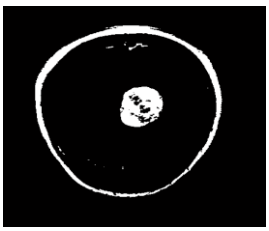
A. Original image



B. after adjustment



C. after image enhancement



D. after apply clustering

E. resulted image after

Apply morphology and tumor is segmented.

Figure 2: Segmentation process of MRI image

Various parameters of segmented portion are calculated as compared with ground truth to achieve accuracy. Like TPRATE, FPRATE, RECALL, ACCURACY, PRECISION and FVALUE. Table 1 show the values of parameters which we calculated.

S. No.	Preci-sion	Recall	Accuracy	FP rate	TP-rate
image 1	0.9782	0.5133	0.9831	4.03E-04	0.5133
image 2	0.9083	0.2984	0.9686	0.0014	0.2984
image 3	1	0.5665	0.9939	0	0.5665
image 4	1	0.7843	0.995	0	0.7843
image 5	0.9875	0.6012	0.9882	2.28E-04	0.6012
image 6	0.5691	0.8782	0.9942	0.0049	0.8782
image 7	0.4335	0.5917	0.9954	0.0031	0.5917
image 8	0.3562	0.5135	0.9746	0.017	0.5135
image 9	0.562	0.6389	0.981	0.0113	0.6389
image 10	0.3562	0.5135	0.9746	0.017	0.5135

TABLE 1: PARAMETER CALCULATION OF SEGMENTED PORTION OF 10 IMAGES

TRUE POSITIVE RATE defines the no of resulted pixels having tumor out of total no of pixel of a image. Figure 3 represents the TP rate of MRI images.

$$TPR = \frac{No\ .of\ Pixels\ having\ Tumor}{Total\ No.of\ Pixels}$$

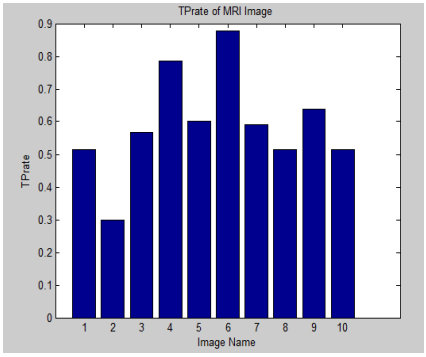


Fig 3: TP rate of MRI images

FALSE POSITIVE RATE defines no of pixels that have not tumor and detect positively out of total no of pixels. Figure 4 represents the FP rate of MRI image.

$$FPR = \frac{No.\ of\ pixels\ haven't\ tumor\ and\ detect\ positively}{Total\ no.\ of\ Pixels\ of\ image}$$

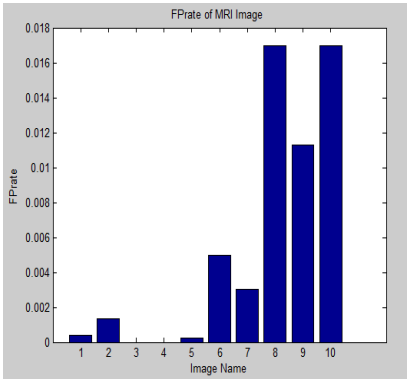


Fig 4: FP rate of MRI images

ACCURACY allude to the exact or closeness of the measured value to the ground truth. Figure 5 shows the accuracy of MRI mask images as compared with segmented images.

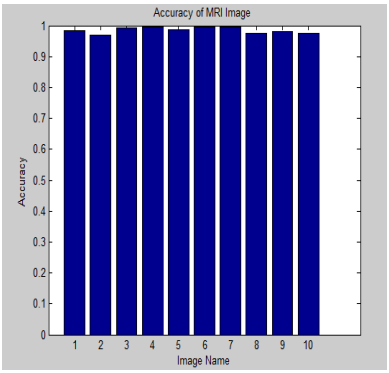


Fig 5: accuracy of MRI images

PRECISION defines how many selected pixels are relevant? Figure 6 shows the precision value of 10 MRI images.

$$Precision = \frac{TPR}{TPR+FPR}$$

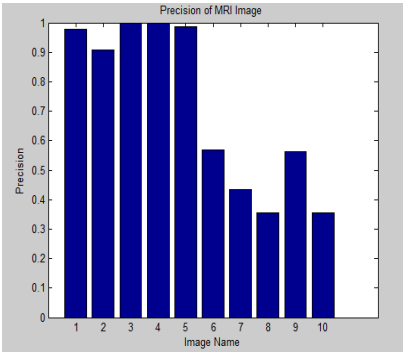


Fig 6: Precision value of MRI images

RECALL defines how many relevant pixels are selected? Figure 7 shows the recall value of 10 MRI images.

$$Recall = \frac{TPR}{TPR+FNR}$$

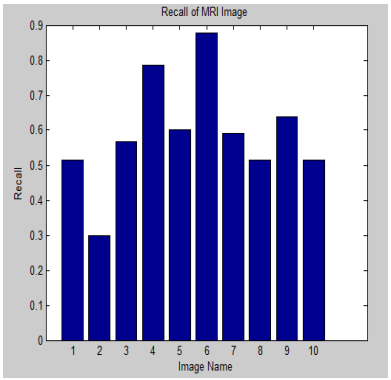


Fig 7: Recall value of MRI images

The feature extraction is extracting the features of cluster of tumor area. Various static features like mean, mode, variance and standard deviation of tumor area are extracted and type of tumor is displayed in following table 2.

S.No.	AREA	I-MEAN	I-MODE	I-VAR	I-STD	TYPE OF TUMOR
image 1	4669	87.3313	100	473.0395	21.7495	1
image 2	3696	92.2484	100	327.5821	18.0992	1
image 3	2100	98.5714	100	69.4208	8.3319	1
image 4	4801	92.1475	100	331.0332	18.1943	1
image 5	4638	96.0328	100	182.6619	13.5152	1
image 6	2989	94.9649	100	226.4797	15.0492	1
image 7	11102	91.5736	100	350.3477	18.7176	2
image 8	15185	93.5463	100	281.0546	16.7647	2
image 9	15092	91.2271	100	361.7039	19.0185	2
image 10	6584	93.0893	100	297.8222	17.2575	2

Table 2: Values of static feature

5. CONCLUSION

A large number of solutions have been observed with image segmentation in different field of medical imaging. In the different field of medical imaging, Magnetic resonance imager scans diagnosis more comfortably rather than CT scan. During last few years, MRI has become an emergent research area in the field of medical imaging system. On the other hand, k-mean clustering can detect a brain tumor faster than others segmentation method. In our research, we found the better results in highlighting the tumor in the segmented portion and extract the features of tumor area. From the experimental results we calculated the various parameters of segmented tumor portion and proved the effectiveness of our approach by extracting the static features.

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