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Optimized Optics Method for Tumor Detection in Brain

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ABSTRACT: In the analysis of Medical images for computer-aided diagnosis and treatment, segmentation is required as a primary stage. Medical image segmentation is a complex and challenging task due to the intrinsic nature of the images. The brain has particularly complex structure and its precise segmentation is very useful for detecting tumors, edema, and necrotic tissues, in order to prescribe related therapy. Magnetic resonance imaging (MRI) is an important diagnostic imaging technique for the early detection of abnormal changes in tissues and organs. MRI Imaging forms one of the core methods to identify Brain Tumors, and access the existence, size and volume of the tumor. Clustering is one of the widely used image segmentation techniques which divide patterns in such a way that samples of the same group are more similar to one another than samples belonging to different groups. Use of Genetic Algorithm with OPTICS method will extract the tumor more accurately then compare to other segmentation method. This paper presents review on some of segmentation methods based on clustering and Region Based with their advantages and disadvantages. Here, also include various measurements like Sensitivity, Specificity and Accuracy of tumor.

KEYWORDS: Clustering, Region Based, segmentation method, brain tumor, MRI, Genetic algorithm, OPTICS.

I. INTRODUCTION

The brain is the most important part of the central nervous system. The structure and function of the brain need to be studied noninvasively by doctors and researchers using MRI imaging techniques. The body is made up of many types of cells. Each type of cell has special functions. When cells lose the ability to control their growth, they divide too often and without any order. The extra cells form a mass of tissue called a tumor [1].A tumor may be primary or secondary. If it is the origin, then it is known as primary. If the part of the tumor spreads to another place and grows on its own, then it is known as secondary [2].

Segmentation is the important tool in medical image processing which helps to make a simple format of medical image which is easier and meaningful to analyse.Image segmentation may be defined as a technique, which partitions a given image into a finite number of nonoveriapping regions with respect to some characteristics, such as gray value distribution, texture distribution, etc [6]. It is used in the medical images to identify the tissue or tumor, to measure the volume of tumor, for the radiation therapy and to locate the object and boundaries. Varieties of methods are available for the medical image Segmentation like thresholding, region growing, clustering, etc.

Even though the segmentation helps to identify the region of interest and for other Application, there may be lack of accuracy because of noisy and nonlinear characteristics of the medical images. These undesirable characteristics of the medical image will lead to partial volume effect, presence of artifacts, and Intensity in homogeneity, etc. It is not expected from the images so the pre-processing step is needed before the segmentation. Preprocessing before the segmentation is improving the performance growing is analyzed here. General biological defects occurring in the brains are tumor [4]. Brain tumor segmentation means segregating tumor from non-tumor tissues. There are various types of malignant tumours such as astrocytoma, meningioma, glioma, MS_PLAQUE and metastatic, which vary greatly in appearance — shape, size and location. Many approaches are based on fuzzy logic, Modified FCM [6].Section 2 presents proposed work methodology, Section 3 discusses results. Finally, we present our conclusion and future scope in Section 4.

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II. PRPOSED WORK

The proposed work is divided in following steps 1.preprocessing 2.feature selection using genetic algorithm and for 3.Extracting tumor area (OPTICS segmentation) is used as shown in fig 2.1.

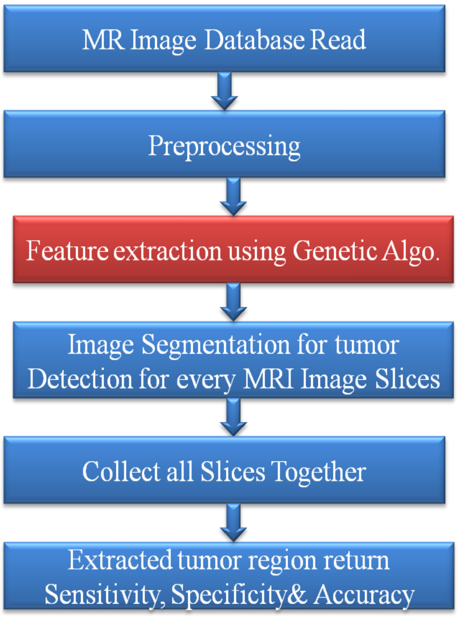

Fig: 2.1 Flow diagram of steps of proposed work.

2.1 Genetic Algorithm.

The propose approach uses the Genetic Algorithm as optimization tool or Feature Extraction tool. In the techworld, now a day to get the best optimal solution GA is widely used in Biomedical for detecting the tumor in any part of body.

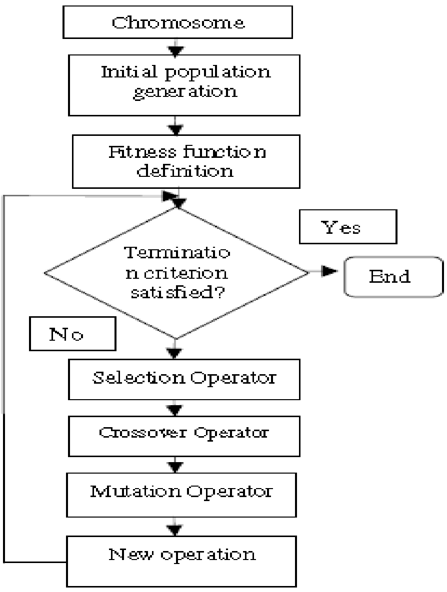

Fig: 2.3 Flow diagram of Genetic algorithm.

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Chromosome is a long thread of DNA .GA also follows the same concept. Flow diagram of implementation of GA for an application is shown [1]. **Initial population generation** The population is generated randomly which allowing the entire range of possible solutions. **Mutation** alters one or more gene values in a chromosome from its initial state. In mutation, the entire solution may change from the previous solution. From that GA can come to better solution by using mutation. **Cross over** is a process of taking more than one parent solutions and producing a child solution from them. Means Recombination. **Fitness function** used to summaries, as a single figure of merit, how close a given design solution is to achieving the set aims.

$$\text{Fitness (f)} = \sum_{i=1}^{20} \frac{TP}{TP+FN} + \frac{TN}{TN+FP} + \frac{TP+TN}{TP+TN+FP+FN} \quad (1)$$

Fitness max represents maximum threshold value for a feature subset.

Best Feature_ Subset =Fitness (f)-Fitnessmax (2)

If the difference between two is 0 to 15 then that particular feature subset is considered as best feature subset. Otherwise mutation and crossover is done to generate new population.

2.2 OPTICS

Ordering Points to Identify the Clustering Structure. OPTICS defines the core distance which is the shortest distance from the core that contains the minimum number of points. Those points within the radius of the core distance may contain points far from the core than all the other points located within the same core distance [9]. OPTICS algorithm is dealing with all slices of brain in parallel and it made the cluster by combining all the points which can be easily extracted.

Following are the steps for OPTICS:

Step1. Specify ε and MinPts.

Step2. Mark all the points in the dataset as unprocessed.

Step3. For each unprocessed point, find its neighbors w.r.t parameters ε and MinPts. Mark the point p as processed.

$$\text{core-dist}_{\varepsilon,MinPts}(p) = \begin{cases} \text{UNDEFINED} & \text{if } |N_\varepsilon(p)| < MinPts \\ MinPts\text{-th smallest distance to } N_\varepsilon(p) & \text{otherwise} \end{cases}$$

$$\text{reachability-dist}_{\varepsilon,MinPts}(o,p) = \begin{cases} \text{UNDEFINED} & \text{if } |N_\varepsilon(p)| < MinPts \\ \max(\text{core-dist}_{\varepsilon,MinPts}(p), \text{dist}(p,o)) & \text{otherwise} \end{cases}$$

Step4. Set the core-distance for the point.

Step5. Add the point to the order file [9].

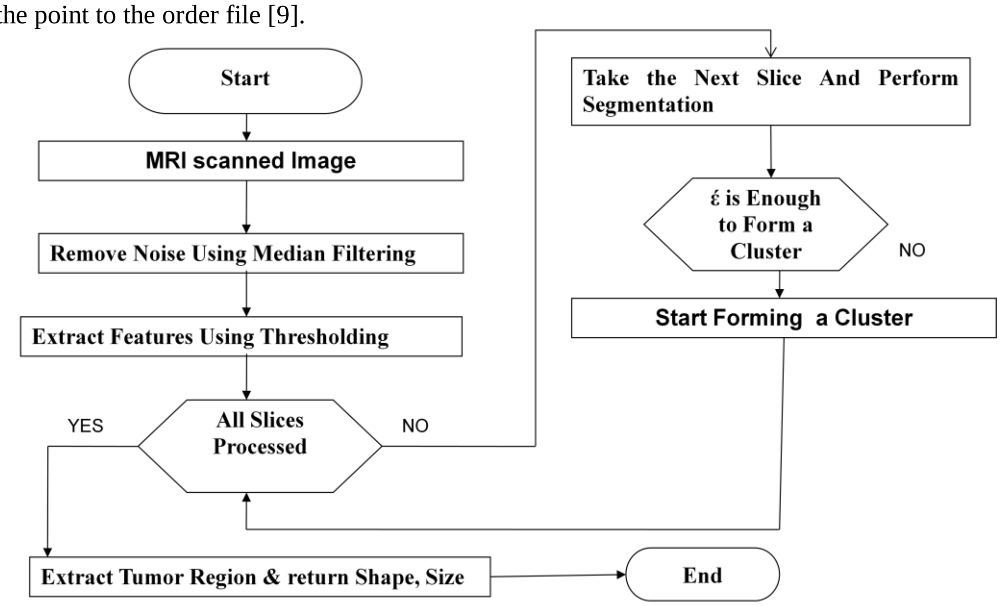

Fig-2.2 Flow Diagram of OPTICS

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III. RESULT

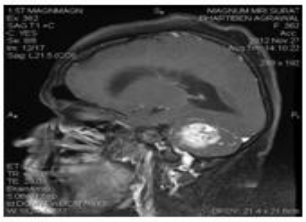
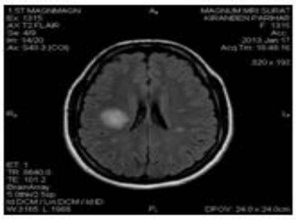
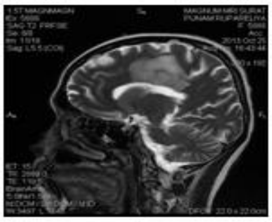


Fig-3.1 (a) Original Image of MENINGIOMA


(b) Original Image of MS PLAQUE


(c) Original Image of sle_vasculitis_tumor

3.1 Tumor Detection Using OPTICS of Different Tumor Type

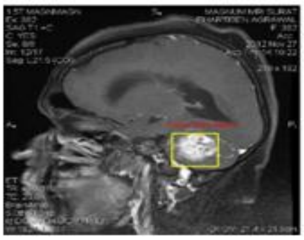
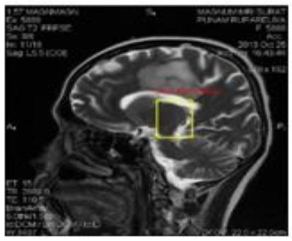


Fig-3.2 (a) MENINGIOMA


(b) MS PLAQUE


(c) sle_vasculitis_tumor

3.2 Tumor Detection Using Optimize(GA) OPTICS of Different Tumor Type

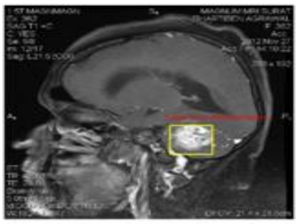
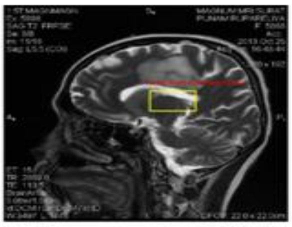


Fig-3.3 (a) MENINGIOMA


(b) MS PLAQUE


(c) sle_vasculitis_tumor

TYPES OF TUMOR	SENSITIVITY	SPECIFICITY	ACCURACY
MENINGIOMA	0.91	0.99	0.95
MS PLAQUE	0.59	0.99	0.77
SLE_VASCULITIS	0.60	0.99	0.77

Table 3.1: Performance Measurement of OPTICS

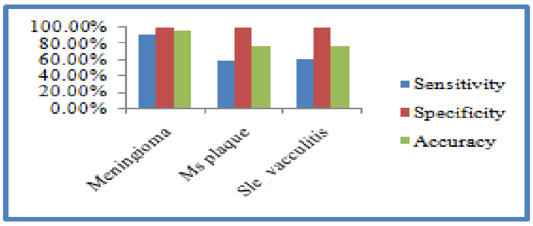


Fig-3.4 Graphical Presentation of OPTICS

TYPES OF TUMOR	SENSITIVITY	SPECIFICITY	ACCURACY
MENINGIOMA	0.94	0.99	0.96
MS PLAQUE	0.44	1.00	0.60
SLE_VASCULITIS	0.81	0.99	0.89

Table 3.2: Performance Measurement of OOPTICS

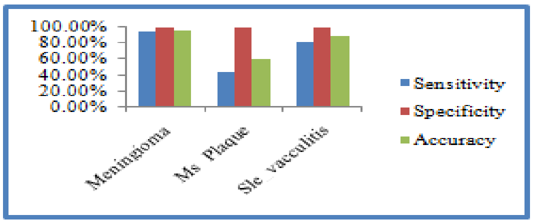


Fig-3.5 Graphical Presentation of OOPTIC

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IV. CONCLUSION AND FUTURE WORK

Image of brain has been analyzed here. It has been processed, to automatically detect the tumorious portion by applying thresholding and segmentation using blob analysis. Using OPTICS we can have a actual real time information about dimensions of the Tumor, which can help doctors to decide what best action plan they can take to treat such cases, without need to use human intelligence to co-relate multiple images OPTICS reduces over segmentation problem. Best for abnormal shape detection. Using Genetic Algorithm misclassification rate reduce more accurately and we can extract the tumor size in early stage and reduce the computation time as well. It also shows the sensitivity, Specificity and Accuracy increase compare to OPTICS. In future it can be apply on other types of tumor and sensitivity can be increase.

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