



SEGMENTATION TECHNIQUES USING SOFT COMPUTING APPROACH WITH GUI

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ABSTRACT Image processing is a method to perform operation on an image. In Digital Image Processing, there are some steps to extract information-pre-processing, remove noise, enhancement and display, information extraction. In segmentation technique it divides the image into several parts.

It is commonly used technique in digital image processing. Accuracy in segmentation of the MRI images is extremely important and essential for the exact diagnosis by computer aided clinical tools. There are various types of segmentation algorithms available for MRI brain images. In this paper we propose only three segmentation techniques under Soft Computing. We propose Soft Computing technique in which we compare all segmentation method and run simultaneously at a time with the help of MATLAB GUI Tool. Simultaneous process executes that method and compare with the help of Soft Computing approach it reduce the execution time rather than execution of all method individual. One by one process will take more time and time complexity will be more.

KEYWORDS : Brain Tumor, Segmentation, Soft Computing and MATLAB GUI Tool

1. INTRODUCTION

Bio-Medical Image has various applications in medical field. A common goal of image processing techniques applied to neuro imaging is to improve detection of abnormal brain tissue, including abnormalities that may not be readily recognizable by visual analysis alone. Image processing is a technique for image analysis developed by computer and Information technology. There are several types of images light intensity (visual) image, range image (depth image) and nuclear resonance image (MRI). The focus of this concept is the use of image processing in tumor detection from the brain by Magnetic Resonance Imaging (MRI), For the brain tumor detection, Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) are the advanced imaging techniques, but most of the experts prefer MRI over CT. MRI is a very popular technique which is used in radiology to analyze internal structure of the body such as brain, kidney etc. The traditional method of tumor detection in MRI images is a manual task which provides variations in the results when analyzed by different experts, therefore, it has some limitations of the manual analysis of MRI, there is a need for an automated system using soft computing technique that can produce globally acceptable and accurate results.

Brain tumor is a dangerous disease of human body. It is necessary to recover the problem of this dangerous disease. The brain is the main part of the central nervous system which performs all the main functions of the body. The brain is a complex organ of the body containing billions of neurons forming a large network [3]. A brain tumor also known as an—intracranial neoplasml is an abnormal growth of mass of tissue in the brain. Brain tumor can be of different shapes and sizes and can appear in any part of the brain which increases its complexity of curing [19]. It is very important and challenging task to recover diseases for physician.

Magnetic resonance imaging (MRI) is often the medical imaging method of choice when soft tissue delineation is necessary [15]. Image processing is the method of partitioning image into similar or different image [19].

Using Medical image it is a challenging task to find out the problem because brain tumor is a abnormal tissue, damaged part of brain and uncontrolled growth of cell. So Detection, identification and analyzing of that abnormal area is a major task of physician. Various techniques were developed for detection of brain tumor. Image segmentation plays important role for effected area of brain. Bio-Medical Image Technologies are X-Ray, CT Scan, Nuclear Medicine Imaging, Ultrasound and advance method is MRI.

2. METHODOLOGY

Capturing image from internal parts of body in Image processing is one of the challenging tasks. This paper reviews various methods for segmentation in detection of Tumor. Magnetic Resonance Imaging (MRI) data is an important but time-consuming manual task performed by medical expert. We need to introduce the method of soft

computing. Under soft computing using MATLAB GUI tool it is using for large data. MATLAB is a high performance language to solve the mathematical problem and expressed the mathematical notation.

Soft computing is an emerging technology of fuzzy system, neuro-system and intelligence system. One of the most important applications is image segmentation.

2.1 Segmentation- Image segmentation is the process of partitioning an image into several parts. Image segmentation is the process of analysis and interpretation of given input data.

2.1.1 Types of segmentation [7], [13] and [19].

- Region based
- Thresholding Based
- Edge based
- Feature based
- Model based
- Clustering based method
- Watershed based
- Partial differential equation
- ANN based Method

a) Region Based Segmentation: This technique based on common patterns in intensity values within a cluster of neighboring pixel. It is similar type's intensity value. The cluster is referred to as the region, and the goal of the segmentation algorithm is to group regions according to their anatomical or functional roles. It is expensive method in terms of time and memory.

b) Thresholding based: Thresholding is the simplest way to perform segmentation, and it is used extensively in many image processing applications. Thresholding is a powerful manual approach for segmenting images having light objects on dark backgrounds. It is simple and effective way of portioning an image into foreground and background according to its intensity value. Convert gray scale image into binary image. Histogram is based on intensity values of binary image. A grayscale image only consists of gray scale values, but MRI images consist of primary colors (RGB) content [11].

c) Edge-based Segmentation: These techniques rely on discontinuities in image values between distinct regions, and the goal of the segmentation algorithm is to accurately demarcate the boundary separating these regions. In the work first they detect all the edge of brain including weak edge by the canny algorithm. It is not suitable for weak and too many edges.

d) Feature Based Segmentation

e) Model based Segmentation/knowledge-based segmentation: These techniques involve active shape and appearance models, active contours and deformable templates.

f) Clustering-

Clustering – There are various types of clustering techniques available. Fuzzy based unsupervised learning techniques are Fuzzy K-means and C-means [6].

Clustering is a task of assigning a set of objects into groups called clusters. In general the clustering algorithms can be classified into two categories. One is hard clustering; another one is soft (fuzzy) clustering. Integration of fuzzy logic with data mining techniques has become one of the key constituents of soft computing in handling challenges posed by massive collections of natural data. The central idea in fuzzy clustering is the non-unique partitioning of the data into a collection of clusters. The data points are assigned membership values for each of the clusters and fuzzy clustering algorithm allow the clusters to grow into their natural shapes [19].

g) Watershed- It is based on topological interpretation. Its results are more stable and detected boundary is continuous but, it has complex calculation of gradients.

h) Partial Differential Equation-It is fastest method based on differential equation. It has more computation complexity.

i) ANN based- Based on intelligence system for decision making process. It has more wastages of time in training.

2.2 Clustering

It used to identify groups of similar object in different data set. Clustering can be used to quantize the available data, to extract a set of cluster prototypes for the compact representation of the dataset, into homogeneous subsets. Clustering is a mathematical tool that attempts to discover structures or certain patterns in a dataset, where the objects inside each cluster show a certain degree of similarity. Cluster analysis is not an automatic task, but an iterative process of knowledge discovery or interactive multi-objective optimization. It will often necessary to modify preprocessing and parameter according to the result achieves the desired outputs. In Clustering, one of the most widely used algorithms is fuzzy clustering algorithms [18] and [19].

Clustering is a Machine Learning technique that is based on the grouping of data points. We can identify by a clustering algorithm to classify each data point into a specific group or similar group, data points that are in the same group or different group should have similar or dissimilar properties and/or features. Clustering is a method of unsupervised learning and is a common for statistical data analysis used in different fields.

2.3 Types of clustering

There are many algorithms are available that are proposed to improve the clustering performance. Fuzzy C means is a very important clustering technique based on fuzzy logic. Fuzzy C Means (FCM) is a very popular soft clustering technique and similarly K-means is an important hard clustering technique [12]. The fuzzy c – means (FCM) algorithms generalizes the hard C - means or K - means clustering algorithm in order to allow a point to partially belong to multiple clusters [16]. C- Means clustering in which each data point can belong to more than one cluster. Clustering can be classified as:

Soft Clustering (Overlapping Clustering) & Hard Clustering (or Exclusive Clustering): [12] and [19].

- (1) FCM is an unsupervised clustering algorithm that is applied to wide range of problems connected with feature analysis, clustering and classifier design. FCM is widely applied in agricultural engineering, astronomy, chemistry, geology, image analysis, medical diagnosis, and shape analysis and target recognition.
- (2) K-means is an exclusive clustering algorithms, Fuzzy C-means is an overlapping clustering algorithm. It takes more time for execution [7]. K-means algorithm is an iterative technique that is used to partition an image into K cluster.

2.4 Comparison of Time Complexity of K-Means and FCM-

The time complexity of K-means [15] is $O(ncdi)$ and time complexity of FCM [4] is $O(nc2i)$ [18]. Clustering – There are various types of clustering techniques available. Fuzzy based unsupervised learning techniques are Fuzzy K-means and C-means [18].

In FCM more than one cluster randomly selected cluster. FCM is the advanced version of K-means clustering algorithm and doing more work

than K-means. K-Means just needs to do a distance calculation, whereas fuzzy c means needs to do a full inverse-distance weighting [7].

There are number of research paper available for comparison of fuzzy techniques. (Fuzzy clustering by contrast allows data points to belong to more than one group.) The resulting partition is therefore a fuzzy partition. Each cluster is associated with a membership function that expresses the degree to which individual data points belong to the cluster among all fuzzy clustering methods[6], [8] and [18].

2.5 Soft computing- Soft computing is a methodology of real world problem. Soft computing is an emerging approach to find the Fuzzy logic, Genetic algorithms and Neuro system problems. It is also known as computational intelligence. It is robust and low solution cost. The goal of soft computing is that to improve the human mind, machine learning techniques and reduce time complexity. Soft Computing plays role in real world problem. Soft computing approach refers to the algorithm in which it deals with the idea of natural probabilistic in real world. Soft computing is likely to play an especially important role in science and engineering, but eventually its influence may extend much farther [8], [14] and [17]. Soft computing is kind of imprecision, uncertainty, partial truth, and approximation.

2.6 Application of soft computing [2]

- Image Processing
- Bio-medical image
- Automated driving
- Decision Support system
- Neuro logic
- Fuzzy logic
- Recognition system
- Automotive system and manufacturing
- Machine Learning Application

3.OBSERVATION AND ANALYSIS

There are some major steps in the proposed approach. Image segmentation is performed to divide the image into multiple segments. After segmentation Fuzzy clustering algorithm is applied on that segmented image. The accuracy of Fuzzy clustering algorithm is higher than k-means [1].

3.1 Processing Analysis

- (1) Manual processing- It is the traditional method will take more time and increase the time complexity. It follows the one by one step and one process is executed after that another process will be executed.
- (2) Batch processing-Batch process is the process in which no. of task is collected in a group or batch. One process is executed after that another process is executed. It follows the one by one process.
- (3) Soft computing- We are using Soft Computing technique; it is Unsupervised Machine Learning Technique in which we can reduce the manual task of image processing. In which no. of process can be run simultaneously at a time. Soft Computing is used in real world problem which are non linear, time-varying with uncertainty and high complexity. Soft Computing also known as computational intelligence for robust, efficient and optimal solution [2]. Soft Computing is used in many fields Medical Science, Engineering, Artificial Intelligence, Power System and control application. Soft Computing Techniques consist of rich knowledge representation, acquisition and processing for solving various applications. In this work the role of soft computing is that run process simultaneously with the help of MATLAB GUI Toolbox.

There are some major steps in the proposed approach. Input image, noise filter, Feature selection, Feature extraction and Classification.

Step 1: Input Image: It is original image.

Step 2: It is must to remove the noise from image. Each image is first applied with denoising technique.

Step 3: The proposed algorithm starts by reading the input image, converting it to grey scale image.

Step 4: Feature selection

Step 5: Feature extraction, the tumor is extracted from the MR image, its exact position and some features also determined.

Step 6: Classification, Then applying image segmentation techniques for extracting the Region of Interest (ROI) with Soft Computing approach. Soft Computing tool run all technique simultaneously. Soft computing tool compare performance of clustering techniques that is

Fuzzy c-means and Fuzzy k-means. The accuracy of Fuzzy clustering algorithm is higher than k-means. It is the combined approaches namely K-means clustering, fuzzy C-means clustering. It is simple and fast algorithm. This algorithm is more robust to noise and provides better segmentation quality.

Step 7: Calculate execution time.

Step 8: Expected outcomes, compare all execution time at the end of the process.

Step 9: Result.

4.RESULT AND DISCUSSION

In Bio-Medical image to remove noise, it is basic factor because image is high and low intensity value of pixel that are stored and handled by a computer. No. of researchers proposed which algorithms are better than each other, in this paper also I compared clustering method for better result.

The aim of this process is to improve the quality of input image without noise. The no. of research paper available they proposed the method of these three segmentation technique by individual performance. They applied there algorithms one by one in a single image. Some papers are like; they compared each other but this paper we proposed the method of Soft Computing that run simultaneously and will give result at a time with these three clustering method. It will reduce the time complexity of execution of segmentation techniques.

4.1 GUI MATLAB TOOLBOX



Fig.1. GUI MATLAB TOOLBOX Using Soft Computing.

GUI Processing MATLAB Toolbox- This toolbox provides tools to create virtually user interface layout. With help from GUI, we can have a program that runs fast and provides a better result with more methods [13]. Working with MATLAB GUI Tool, we can add more features of images and we obtain superior results than the traditional techniques for tumor detection. Using the GUI based programs allows us to change the parameters without rewriting the program and allows fast and efficient detection of tumors. The results are clearly more accurate and faster [13]. GUI also reduced the manual task followed by one by one step.

(1) Manual inspection by FCM Clustering

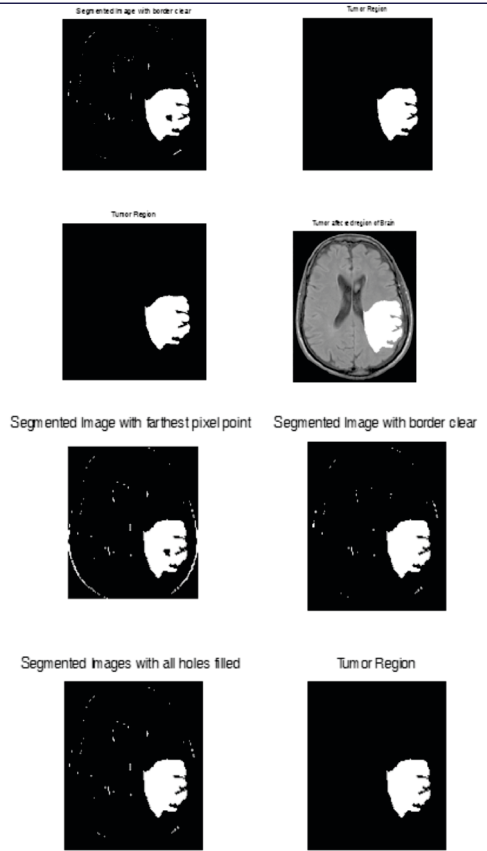
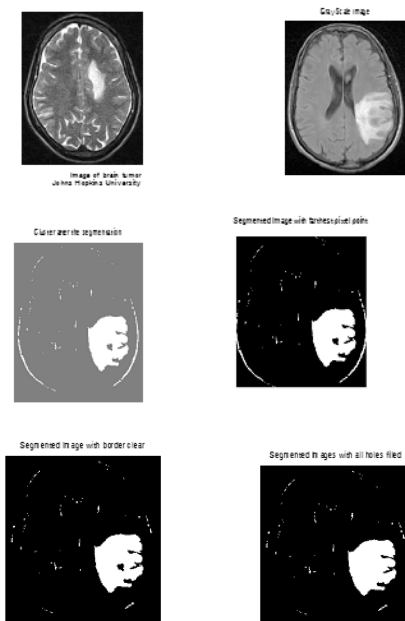
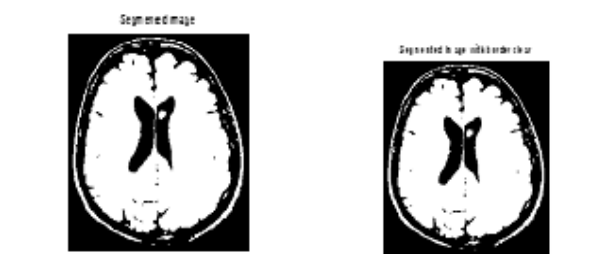
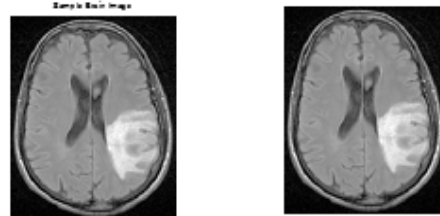
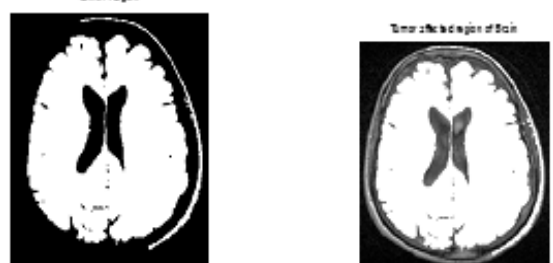


Fig.2. FCM Clustering (2) Manual inspection by HISTOGRAM Clustering

(2) Manual inspection by HISTOGRAM Clustering

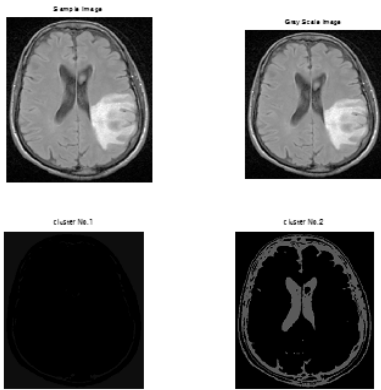


1.Original Image 2. Gray scale image 3.Segmented image 4. Segmented image with border clear

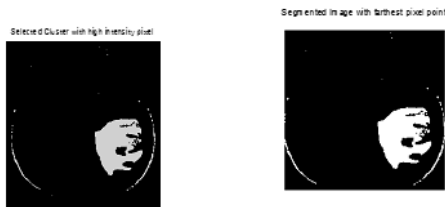


5. Tumor Region 6. Tumor affected region of brain Fig.3. Histogram Clustering

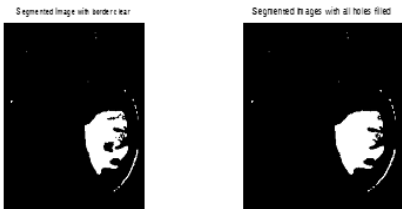
(3) Manual inspection by K-MEANS



1.Original image 2. Gray scale image 3. Cluster no. 1 4. Cluster no. 2



5.Cluster no.3 6. Cluster no. 4 7.Segmented Cluster with high intensity pixel 8. Segmented image with farthest pixel point.



9. Segmented image with border clear 10. Segmented image with all holes filled 11. Tumor region 12. Tumor effected region of brain Fig.4. K-Means Clustering

1.Individual Comparison by FCM

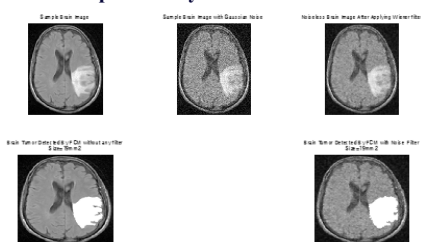


Fig.5. Individual Comparison by FCM

2.Individual Comparison by Histogram

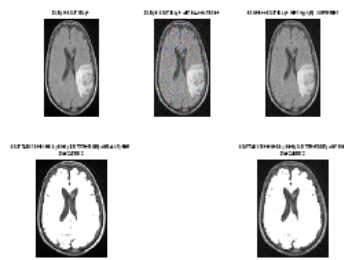


Fig.6. Individual Comparison by Histogram

3.Individual Comparison by K-Means

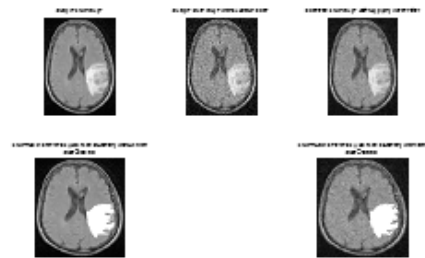


Fig.7. Individual Comparison by K-Means

4.All method Comparison by Soft Computing(Reduction of time complexity)

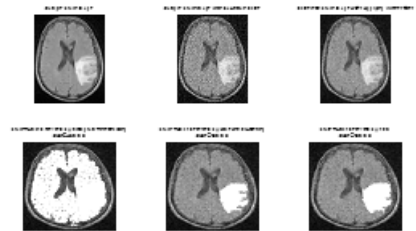


Fig.8. All method Comparison by Soft Computing

5.All method Comparison by Soft Computing with Histogram

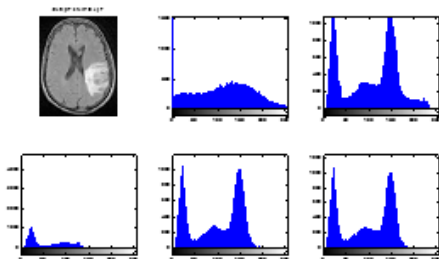


Fig.9. All method Comparison by Soft Computing with Histogram

5.CONCLUSION

To find out the affected area of brain is a complicated task. Accuracy is most important in medical image; it is done by only Medical expert. The image segmentation remains a challenging problem in medical MRI brain image processing [6]. I proposed the algorithms for accuracy and reliable of high efficiency and performance to achieved better quality image. K-means is better than FCM [18]. To achieves more efficient accuracy in the result and reduces the time of execution we propose a Soft Computing Model; it is one of the algorithm in which we are trying to calculating the segmentation techniques for expected outcomes. Unsupervised learning is an effective method of partitioning image and gives better result in the brain than supervised learning.. Co-processing is done by soft computing, it reduce the execution time to enhance the input MRI scan image. Brain tumor area is detected by using region growing segmentation and Brain tumor boundary is detected by using edge based segmentation. Segmentation

detection will give exact and clear boundaries or edges. On the basis of Observation and Analysis, it is found that manual brain image analysis for brain tumor detection is a time taking task, so need to reduce the execution time with Soft Computing. It executes the these three techniques simultaneously at a time

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