A Survey on Improved Brain Tumor Segmentation and Detection Using EM and FCM Algorithm

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Abstract: This paper deals with the implementation of Simple Algorithm for detection of range and shape of tumor in brain MR images and predicts the disease risk details from the given area of tumor. Tumor is an uncontrolled growth of tissues in any part of the body. Tumors are of different types and they have different Characteristics and different treatment. As it is known, brain tumor is inherently serious and life-threatening because of its character in the limited space of the intracranial cavity (space formed inside the skull). Most Research in developed countries show that the number of people who have brain tumors were died due to the fact of inaccurate detection. Generally, CT scan or MRI that is directed into intracranial cavity produces a complete image of brain. After researching a lot statistical analysis which is based on those people whose are affected in brain tumor some general Risk factors and Symptoms have been discovered. The development of technology in science day night tries to develop new methods of treatment. This image is visually examined by the physician for detection & diagnosis of brain tumor. However this method accurate determines the accurate of stage & size of tumor and also predicts the disease details from the area of tumor. This work uses segmentation of brain tumor based on the k-means and fuzzy c-means algorithms. This method allows the segmentation of tumor tissue with accuracy and reproducibility comparable to manual segmentation. In addition, it also reduces the time for analysis and predicts the disease details from the given area of tumor. Finally implement a system using java to predict Brain tumor risk level which is easier, cost reducible and time savable.

Keywords: Abnormalities, Magnetic Resonance Imaging (MRI), Brain tumor, Pre-processing, fuzzy c-means, Thresholding.

1. INTRODUCTION

The tumor may be primary or secondary. If it is an origin, then it is known as primary. If the part of the tumor is spread to another place and grown as its own then it is known as secondary.

Normally brain tumor affects CSF (Cerebral Spinal Fluid). It causes for strokes. The physician gives the treatment for the strokes rather than the treatment for tumor. So detection of tumor is important for that treatment. The lifetime of the person who affected by the brain tumor will increase if it is detected at current stage. That will increase the lifetime about 1 to 2 years.

Normally tumor cells are of two types. They are Mass and Malignant. The detection of the malignant tumor is somewhat difficult to mass tumor. In this paper we focused on detection of brain tumor with the help of Brain MRI images and predict the disease details from the given area of tumor.

Treatment for brain tumor depends on the type and stage of the disease, the size and place of the tumor, and your general health and medical history. In most cases, the goal of treatment is to remove or destroy the tumor completely. Most brain tumor can be cured if found and treated early. A person who was affected by any kind of tumor has an increased risk of developing another brain tumor of any type. A person who has two or more close relatives (mother, father, sister, brother, or child) who are responsible for developing brain tumor has a risk factor of developing brain tumor for his own.

The Objective of this work is to contract such a tool which can tell people about his/her approximate condition about brain tumor ,that is he or she in risk or not and how much? So, we are providing systems that detect the tumor and its shape and disease details from the given area of tumor.

This work deals with the concept for brain tumor segmentation and finally the detection of brain tumor and risk of disease. In this work, two algorithms are used for segmentation, K-means clustering algorithm

and Fuzzy C algorithm. So it gives the accurate result for tumor segmentation.

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A person who was affected by any kind of tumor has an increased risk of developing another brain tumor of any type. A person who has two or more close relatives (mother, father, sister, brother, or child) who are responsible for developing brain tumor has a risk factor of developing brain tumor for his own. Rarely, members of a family will have an inherited disorder that makes the brain more sensitive and increases the risk of brain tumor. About 5% of brain tumors may be linked to hereditary (genetic) factors or conditions.

1.1 Motivation

A reliable method for segmenting tumour would clearly be a useful tool. Currently, however, there is no method widely accepted in clinical practice for quantitating tumour volumes from MR images.The main objective of this paper is to detect the brain tumor of MRI image and calculating its area and identify stage of tumour which is easier, cost reducible and time saveable.

1.2 Problem Statement

There are some algorithms like thresholding method, region growing, using only k-means algorithm but all these algorithm are not able to extract all fine spatial characteristics of MRI image. Thus there is a problem with these algorithms as they are not successfully detecting the brain tumor in the image.

Brain tumor is a disease of the brain in which tumor cells (malignant) arise in the brain tissue. Tumor cells grow to form a mass of tumor tissue that interferes with brain functions such as muscle control, sensation, memory, and other normal body functions.

2. REVIEW OF LITERATURE

Literature survey is the most important step in any kind of research. Before start developing we need to study the previous papers of our domain which we are working and on the basis of study we can predict or generate the drawback and start working with the reference of previous papers.

In this section, we briefly review the related work on brain Tumour detection and segmentation.

J.selvakumar, A.Lakshmi and T.Arivoli, "Brain Tumor Segmentation and Its Area Calculation in Brain MR Images using K-Mean Clustering and Fuzzy C-Mean Algorithm", This paper has proposed a system of image registration and data fusion theory adapted for the segmentation of MR images. This system provides an efficient and fast way for diagnosis of the brain tumor called K-means algorithm. Implanting the K-mean algorithm which consists of multiple phases. First phaseconsists of registration of multiple MR images of the brain taken along adjacent layers of brain. In the second phase, theseregistered images are fused to produce high quality image for the segmentation. Finally, segmentation is done by improved K -means algorithm with dual localization methodology. [1]

Samir Kumar Bandhyopadhyay and TuhinUtsab Paul, "Automatic Segmentation of Brain Tumor from Multiple Images of Brain MRI"In this project, author described the three algorithms namely K Means clustering, Expectation Maximization and the Normalized cuts and compare them for image segmentation. The segmentation technique addresses the problem of segmenting an image into different regions. So the authors can analyze both k-mean and C-mean algorithm in easy way. [2]

A. Meena, "Spatial Fuzzy C-Means PET Image Segmentation of Neurodegenerative Disorder" ,Meena and Rajaproposed an approach of Spatial Fuzzy C means (PET-SFCM) clustering algorithm on Positron Emission Tomography (PET) scan image datasets.The proposed FCM successful able to join the spatial neighborhood information with classical FCM and updating the objective function of each cluster. It exploits the segmentation which used for quick bird view for any problem of K-means. [3]

SumanTatirajua and Avi Mehta, "Avoiding energy holes in wireless sensor networks with nonuniform node distribution,"In this paper proposed k-means and C-mean to extract the features from the images.K-Means and Fuzzy C- Means In this process the tumor is extracted from the MR image and its exact position and the shape also determined. The stage of the tumor is displayed based on the amount of area calculated from the cluster. [4]

AjalaFunmilola A, Oke O.A, Adedeji T.O and Alade O.M, Adewusi E.A, "Fuzzy k-c-means Clustering Algorithm for Medical Image Segmentation",Funmilola et al proposed the Fuzzy K-C-means method, which carries more of Fuzzy C-means properties than that of K-means. The F-K-C means focused attention on Clustering methods. These k-mean and C-mean algorithms were

combined together to come up with another method called fuzzy k-c-means clustering algorithm, which has a better result in terms of time utilization. [5]

Beshiba Wilson and Julia Punitha Malar Dhas, " An Experimental Analysis of Fuzzy C-Means and K-Means Segmentation Algorithm for Iron Detection in Brain SWI using Matlab",Wilson and Dhas used K-means and Fuzzy C-means respectively to detect the iron in brain using SWI technique. Susceptibility-weighted imaging (SWI) is a neuro imaging technique, which uses tissue magnetic susceptibility differences to generate a unique contrast. The extraction of the iron region in the brain is made by K-means and Fuzzy C-means clustering method. [6]

M.H. FazelZarandia, M. Zarinbal and M. Izadi, "Systematic image processing for diagnosing brain tumors",This paper proposed a dip study of brain tumor. It describes different type of diagnosis approaches. A brief knowledge about tumor like glial tumor which cover 30 % of all brain tumors.[7]

Samarjit Das, "Pattern Recognition using the Fuzzy c-means Technique"In the field of pattern recognition due to the fundamental involvement of human perception and inadequacy of standard Mathematics to deal with its complex and ambiguously defined system, different fuzzy techniques have been applied as an appropriate alternativeThe proposed fuzzy c-means technique Euclidean distance has been used to obtain the membership values of the objects in different clusters; in the authors work along with Euclidean distance they have used other distances like Canberra distance, Hamming distance to see the differences in outputs. [8]

Vignesh Rajesh, BharathanVenkat, Vikesh Karan and M. Poonkodi, "Brain Tumor Segmentation and its Area Calculation in Brain MR Images Using K-Mean Clustering and Fuzzy C-Mean Algorithm",This paper has suggested a synergistic and an effective algorithm for the detection of brain tumors based on Median filtering, K Means Segmentation, FCM Segmentation, and finally, threshold segmentation. The implemented methods enhance the quality of the tumor images acquired by the aid of MRI and then to detect the size of the tumors, approximate Reasoning is applied.[9]

Krishna Kant Singh1 and Akansha Singh, "A Study of Image Segmentation Algorithms For Different Types Of Images", In this paper the author gives a study of the various algorithms that are available for color images, text and gray scale images. Implementation of segmentation technique those are color-based-segmentation, pixel-based segmentation and edge-based segmentation. [10]

Miss.ShrutikaSantoshHunnur, AkshataRaut, Swati Kulkarni," Implementation of image processing for detection of brain tumor" , The paper is proposed by processing of magnetic resonance image (MRI) is one among the parts of the image processing in medical field and describes the detection of brain tumor by thresholding method. [11]

Priyanka S.Jadhav, MeetaBakuli, "Brain tumor detection using MRI image processing", This paper is proposed by MRI technique.This MRI is used for taken on brain tumor image in separated and collected for more information of brain tumor. [12]

3. PROPOSED METHOD

The proposed system has mainly four modules: preprocessing, segmentation, Feature extraction, approximate reasoning and classification. Pre-processing is done by filtering. Segmentation is carried out by advanced Fuzzy C-means and Expectation-Maximization Algorithms. Feature extraction is by thresholding and finally, Approximate reasoning method to recognize the tumor shape and position in MRI image and predict the disease risk from result area of brain tumor. I.e. finally implement a system to predict Brain tumor risk level which is easier, cost reducible and time savable.

Advantages of Proposed System

1. It consist two algorithms for clustering and classification which effectively able to extract tumor from image and gives the actual final result.
2. This proposed system effectively able to extract all the spatial characteristics of an Image.

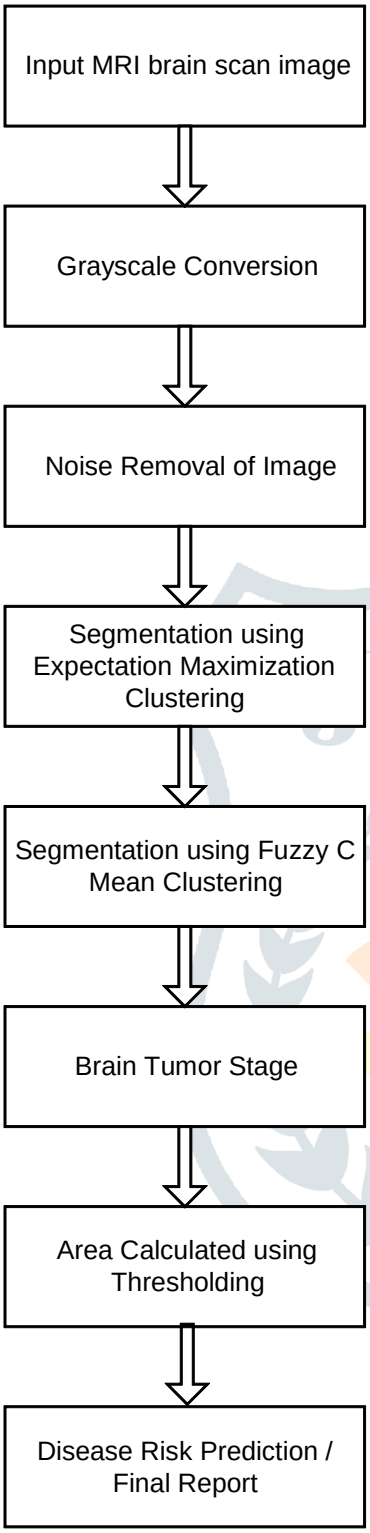

Fig.2 Proposed System Architecture

Conclusion

Brain Tumor segmentation is carried out in this presented work. Firstly image pre-processing is done using median filter technique. If there is any noise are present in the MR image it is removed using Gaussian filter. The noise free image is given as an input to the fuzzy C mean and tumor is extracted from the MRI image. And then segmentation using expectation–maximization (EM) algorithm for accurate tumor shape extraction of malignant tumor and thresholding of output in feature extraction. Finally approximate reasoning step for calculating tumor area and position calculation and finally to identify stage of tumor from resultant area of tumor i.e. identifies stage of tumor which is easier, cost reducible and time savable. The experimental results are compared with other algorithms. The proposed method gives more accurate result.

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