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Brain Tumor Segmentation Using Ant Colony, Fuzzy C-Means Clustering and Its Calculation of Area and Stage

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ABSTRACT: This work deals with the implementation of Simple Algorithm for detection of range and shape of tumor in brain MR images and identifies stage of tumor from the given area of tumor. 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 MRI scan 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 identifies stage of tumor from the area of tumor. This work uses segmentation of brain tumor based on the ant colony optimization 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 identifies stage of tumor from the given area of tumor. Finally implement a system using java to identify stage of tumor which is easier, cost reducible and time savable.

KEYWORDS: Abnormalities, Magnetic Resonance Imaging (MRI), Brain tumor, Pre-processing, Ant colony optimization, fuzzy c-means, Thresholding.

I. INTRODUCTION

A.BACKGROUND

This work deals with the concept for brain tumor segmentation and finally the detection of brain tumor and stage of tumor. Normally the anatomy of the Brain can be viewed by the MRI scan or CT scan. In this work the MRI scanned image is taken for the entire process. The MRI scan is more comfortable than CT scan for diagnosis. It is not affect the human body. Because it doesn't use any radiation. It is based on the magnetic field and radio waves. There are different types of algorithm were developed for brain tumor detection. But they may have some drawback in detection and extraction.

In this work, two algorithms are used for segmentation. Ant Colony Optimization algorithm and Fuzzy C mean algorithm. So it gives the accurate result for tumor segmentation. Tumor is due to the uncontrolled growth of the tissues in any part of the body. 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

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somewhat difficult to mass tumor. In this paper we will focused on detection of brain tumor with the help of Brain MRI images and identify stage of tumor from the given area of tumor.

Treatment for brain tumor depends on the type and stage of the tumor, 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. 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.

Day by day the number of brain tumor person is increasing rapidly because of unconsciousness. 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?The developing platform for the detection is java. At the end, we are providing systems that detect the tumor and its shape and identify stage of tumor from the given area of tumor.

B. GOAL

MR imaging has become a widely-used method of high quality medical imaging, especially in brain imaging where MR's soft tissue contrast and non-invasiveness are clear advantages. MR images can also be used to track the size of a brain tumor as it responds (or doesn't) to treatment. A reliable method for segmenting tumor would clearly be a useful tool. Currently, however, there is no method widely accepted in clinical practice for quantitating tumor volumes from MR images. After researching a lot statistical analysis which is based on those people whose are affected in brain cancer some general Risk factors and Symptoms have been discovered.

C. OBJECTIVE

1. Identify the brain tumor on given image.
2. Detect the brain tumor part in given image.
3. Calculate the area of brain tumor.
4. Identify the stage of tumor.
5. Predict the accurate disease from the given area of tumor.

II. RELATED WORK

This proposed system proposes a computer aided detection approach to diagnose brain tumor in its early stage using Mathematical Morphological Reconstruction (MMR). Image is pre-processed to remove noise and artifacts and then segmented to find regions of interest with probable tumor. A large number of textural and statistical features are extracted from the segmented image to classify whether the brain tumor in the image is benign or malignant [1].

The proposed method, using Gabor filter and support vector machines, classifies brain MRI slices as normal or abnormal. Accuracy, sensitivity, specificity and ROC-curve have been used as standard quantitative measures to evaluate the proposed algorithm. To the best of our knowledge, this is the first study in which experiments have been performed on Whole Brain Atlas-Harvard Medical School (HMS) dataset, achieving an accuracy of 97.5%, sensitivity of 99%, specificity of 92% and ROC-curve as 0.99 [2].

This work dealswith the various aspects of the brain tumor detection. The work discusses the significant researches which are meantfor brain tumor detection through MRI qualityenhancement, MRI segmentation and MRI classification (ascancerous or not). The outcome of the work discussed thatthere were no proper researches are performed to detect thebrain tumor, focused on good quality of image, lessresearches on segmentation and classification of braintumor. Finally the paper gives the future research scope toovercome the addressed research gap [3].

In the present scenario, theradiologists have to manually study the tumors with the availablemedical imaging tools and generate a report. The process is timeconsuming. Although many progresses have been made, butsegmentation of brain tumors from MR Images in a quick,accurate, authentic and reproductive way is still a challengingissue. To overcome

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this problem a system which will detect the tumor and will classify them as benign and malignant has been proposed in this work by using image processing in integration with machine learning, which will help to detect the tumor and classify them into benign and malignant in quick time. In this work step by step procedure for image pre-processing, segmenting brain tumor using morphological operations, extracting tumor feature using DWT and classification of the tumor using SVM is accomplished with the actual clinical data [4].

In this work they used Deep Neural Network classifier which is one of the DL architectures for classifying a dataset of 66 brain MRIs into 4 classes e.g. normal, glioblastoma, sarcoma and metastatic bronchogenic carcinoma tumors. The classifier was combined with the discrete wavelet transform (DWT) the powerful feature extraction tool and principal components analysis (PCA) and the evaluation of the performance was quite good over all the performance measures [5].

Detection of brain tumor is very common fatality in current scenario of health care society. Image segmentation is used to extract the abnormal tumor portion in brain. Brain tumor is an abnormal mass of tissue in which cells grow and multiply uncontrollably, apparently unregulated by mechanisms that control cells. Several techniques have been developed for detection of tumor in brain. The main concentration of this proposed work is on the techniques which use image segmentation to detect brain tumor. Tumor classification and segmentation from brain computed tomography image data is an important but time consuming task performed by medical experts [6].

Advanced MRI modalities such as perfusion-weighted imaging (PWI), diffusion-weighted imaging (DWI) and magnetic resonance spectroscopic imaging (MRSI) have already shown their added value in tumor tissue characterization, hence there have been recent suggestions of combining different MRI modalities into a multiparametric MRI (MP-MRI) approach for brain tumor segmentation. In this work, they compare the performance of several unsupervised classification methods for HGG segmentation based on MP-MRI data including cMRI, DWI, MRSI and PWI. Two independent MP-MRI datasets with a different acquisition protocol were available from different hospitals. They demonstrate that a hierarchical nonnegative matrix factorization variant which was previously introduced for MP-MRI tumor segmentation gives the best performance in terms of mean Dice-scores for the pathologic tissue classes on both datasets [7].

In this paper we propose adaptive brain tumor detection, Image processing is used in the medical tools for detection of tumor, only MRI images are not able to identify the tumorous region in this paper we are using K-Means segmentation with preprocessing of image. Which contains de-noising by Median filter and skull masking is used. Also we are using object labeling for more detailed information of tumor region. To make this system an adaptive we are using SVM (Support Vector Machine), SVM is used in unsupervised manner which will use to create and maintain the pattern for future use. Also for patterns we have to find out the feature to train SVM [8].

Proposed system of image registration and data fusion theory adapted for the segmentation of MR images. Propose 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. This system provides an efficient and fast way for diagnosis of the brain tumor called K-means algorithm [9].

Wilson and Dhas used K-means and Fuzzy C-means respectively to detect the iron in brain using SWI technique. An accurate assessment of iron accumulation is required for diagnosis and therapy of iron overload in various neurodegenerative diseases. Susceptibility Weighted Imaging (SWI) offers information about any tissue that has a different susceptibility than its surrounding structures [10].

III. PROPOSED SYSTEM

The proposed system has mainly four modules: preprocessing, segmentation, Feature extraction, approximate reasoning and classification. Pre processing is done by filtering. After that Ant Colony Optimization and then Segmentation is carried out by Fuzzy C-means algorithms. Feature extraction is by thresholding and finally, Approximate reasoning method to recognize the tumor area and position in MRI image and identify stage of tumor from result area of brain tumor. I.e. finally implement a system to identify stage of tumor which is easier, cost reducible and time savable.

The proposed method is a combination of two algorithms.

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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.

IV. PROPOSED SYSTEM ARCHITECTURE

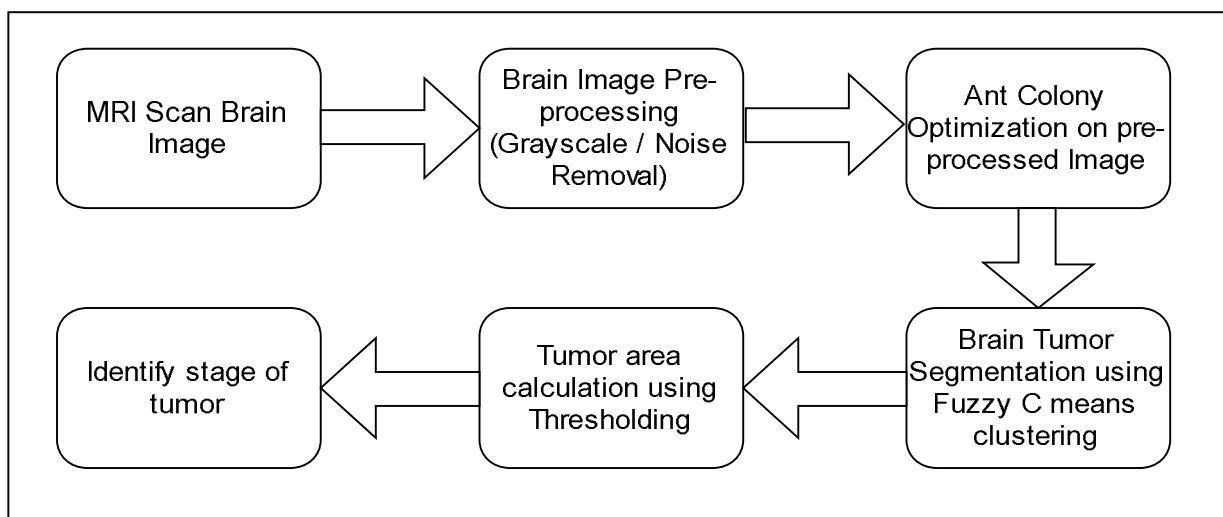


Figure: Proposed System Architecture

1. Pre-processing

According to the need of the next level the pre-processing step convert the image. It performs filtering of noise and other artifacts in the image and sharpening the edges in the image. RGB to grey conversion and Reshaping also takes place here. It includes median filter for noise removal. The possibilities of arrival of noise in modern MRI scan are very less. It may arrive due to the thermal effect. The main aim of this paper is to detect and segment the tumor cells. But for the complete system it needs the process of noise removal.

2. Ant Colony Optimization

Steps:

Step one: In this step the positions of totally K ants, as well as the pheromone matrix $T^{(0)}$ and parameters are initialized.

Step two: For the construction-step index $n=1: N$

- For the ant index $k = 1: N$

• Consecutively move the k^{th} ant for L steps according to a probabilistic transition matrix $p^{(n)}$, (with a size of $M1M2 \times M1M2$).

- Update the pheromone matrix $T^{(n)}$.

Step three: Make the solution decision according to the final pheromone matrix $T^{(N)}$.

3. Segmentation using Fuzzy C means

The fuzzy logic is a way to processing the data by giving the partial membership value to each pixel in the image.

The membership value of the fuzzy set is ranges from 0 to 1.

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Fuzzy clustering is basically a multi valued logic that allows intermediate values i.e., member of one fuzzy set can also be member of other fuzzy sets in the same image. There is no abrupt transition between full membership and non-membership.

The membership function defines the fuzziness of an image and also to define the information contained in the image.

4. Approximate reasoning

In the approximate reasoning step the tumor area is calculated using the binarization method. That is the image having only two values either black or white (0 or 1). After that find the stage of tumor from the given area of tumor and also predict the disease risk details.

V. CONCLUSION

There are different types of tumors are available. They may be as mass in brain or malignant over the brain. The ACO optimization algorithm is inspired by the natural food-searching behavior of some ant species. An improved ACO algorithm using probabilistic atlas is proposed to segment MR brain images Segmentation using Fuzzy C means for accurate tumor shape extraction of malignant tumor and thresholding of output in feature extraction. Finally approximate reasoning for calculating tumor area and position calculation and finally identify stage of tumor from resultant area of tumor. I.e. identify stage of tumor which is easier, cost reducible and time savable. The proposed method will gives more accurate result.

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