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A REVIEW ON BRAIN TUMOR DETECTION USING BFCFCM ALGORITHM

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Abstract - *Brain tumor is abnormal growth of cells within the brain which may be cancerous or non-cancerous. Normally the anatomy of the brain can be viewed by MRI scan or CT scan. The MRI scan is more comfortable than any other scan for diagnosis of Brain tumor. MRI does not practice any radiation so it will not affect the human body. The current work presents various segmentation techniques that are used to detect brain tumor. The algorithm based on segmentation using clustering techniques deals with the steps pre-processing, skull masking, segmentation, feature extraction and classification. After segmentation which is done through c-means clustering algorithm the Brain tumor is detected and its exact location is identified. Also the patient's stage is identified by this process whether it can be cured with medicines or not.*

Key Words: **MRI, Skull masking, SVM, ROI**

1. Introduction

Brain is the most important part of central nervous system. It has very complex structure. Brain is safely tightly safeguarded inside skull that protects it from normal disease. The Brain consists of white matter and gray matter. Cerebrum, Cerebellum and the Brain stem are the three main parts of Brain. Memory sensation and personalities are affected when Brain gets damaged. Tumor is the abnormal growth of tissues which causes damage to the functioning cell. There are two type of tumor which is Benign and Malignant tumor. Benign is non-cancerous and malignant is cancerous tumor. Surgery, chemotherapy and radiation therapy are widely used treatment methods for the diagnosis of Brain tumor. In last decades, radiologists perform the diagnosis of Brain tumor manually on MRI images but it is very time consuming process. With the advances of digital image processing radiologists have a chance to improve their performance with automatic methods like computer aided detection (CAD) system and artificial neural network. MRI gives high quality images and MR image can be segmented into different tissue classes such as white matter, gray matter and cerebrospinal fluid. In order to generate or display digital images MRI strongly depends on computer technology. Detection of Brain tumor from MR images is a very complex medical process. It cannot perform without image processing technique. The segmentation and clustering algorithm is used for the detection of brain tumor with the study of physical and mental condition of the person. In surgical and radiological operations it is used to find the exact location and area of tumor.

2. Literature survey

Shweta Jain, Shubha Mishra proposed the artificial neural network approach namely Back propagation network (BPNs) and probabilistic neural network (PNN) to classify brain cancer. It is used to classify the type of tumor in MRI images of different patients with Astrocytoma type of brain tumor.

V.P. Gladis Pushpa Rathi and Dr. S. Palani proposed a novel method to classification of brain tumor using Linear Discriminant Analysis which includes this steps, Image collection, Normalization, Intensity, shape and Texture feature extraction, feature selection and classification. In this method the shape, Intensity and Texture features are extracted and used for classification. Vital features are selected using Linear Discriminat Analysis (LDA). The results are compared with Principal Component Analysis (PCA) dimension reduction techniques. The number of features selected or features extracted by PCA and the classification accuracy by The Support Vector Machine (SVM) is 98.87%. then train the system by both continuous and without continuous data to minimize the error rate as well as increase the classification accuracy R. J. Deshmukh and R.S Khule proposed Neuro-fuzzy systems use the combined power of two methods: fuzzy logic and artificial neural network (ANN) using to detect the brain tumor. The work carried out involves processing of MRI images of brain cancer affected patients for detection and Classification on different types of brain tumors. A suitable Neuro Fuzzy classifier is developed to recognize the different types of brain tumors.

P.B.Nikam and V.D.Shinde proposed brain image classification and detection using distance classifier method, this theses presents a system for automatic classification of healthy or affected person using Region growing segmentation by watershed algorithm, Euclidean distance classifier for fast computation, accompanied with pre-processing and post processing method apply on database consisting both normal and timorous samples of MR brain images. This system had two main stages, first is pre-processing of MRI images and then other post processing operations, which includes operations like noise removal, convert input image into gray scale image, High pass filter. Segmentation process using Threshold segmentation; it is the most common approach for detecting meaningful discontinuities in gray level, second applied Morphological

operations and feature extracting process. Their work used Watershed for segmentation and considers the gradient magnitude of an image as a topographic surface and Euclidean distance classifier; this classifier based on the distance measure is direct and simple. The mean class values are used as class centers to calculate pixel-center distances for use by the Euclidean distance rule. For major level classification of a homogeneous area this scheme is better. Its advantageous nature comes from the minimum time it takes to classify Distance Measures are used to group or cluster brightness values together. The result ensures that the method is efficient , and satisfying for quick detection whether person is healthy or unhealthy.

3. Proposed Method:

The proposed system has five modules: Pre-processing, skull masking, segmentation, feature extraction and classification. Preprocessing is done by filtering, segmentation is done by advanced fuzzy c-means algorithm, feature extraction is done by thresholding and finally SVM (support vector machine) classifier is used for classification.

A. Block Diagram:

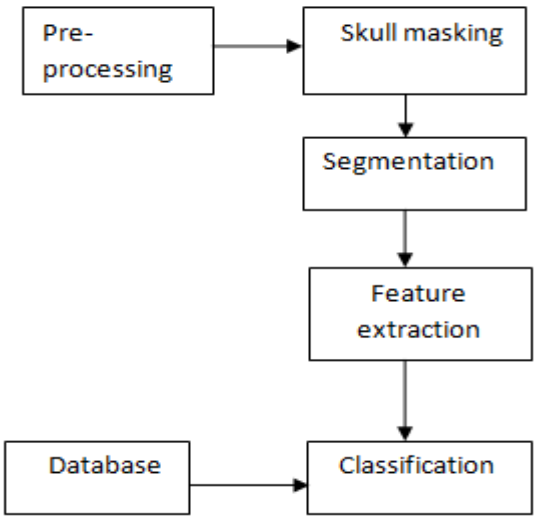


Fig. Block Diagram for proposed method

Pre-processing:

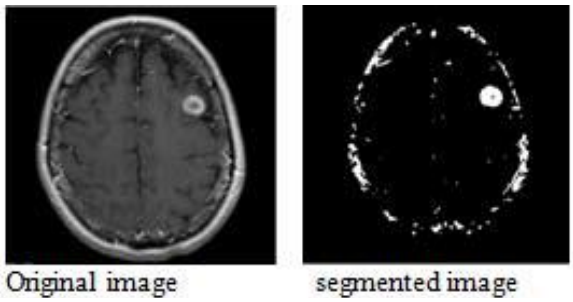
The pre-processing convert the image according to the need of next level. It performs filtering of noise and other artifacts in image. Image filtering is preprocessing stage used for reducing image noise and highlighting important portions. RGB to gray conversion and reshaping also takes place in preprocessing.

Skull masking:

Detection of skull is used to control the boundaries of the object. The edge information helps to find out the region of interest (ROI) i.e. the portion of the image covering the tumor. This work is done with the help of the calculating the centroid in the image. Extraction of brain tissue from non-brain tissues in MR images which is referred to as skull stripping is an important step in many neuron imaging studies. In this, we used automatic threshold value selector to automatically choose threshold value. Then, mathematical morphology operations on a binaries image are applied stage by stage to achieve acceptable skull stripped brain images. The proposed skull stripping method comprises four steps. Initially image binarisation is completed using threshold value and narrow connections are removed from binarised image using morphological opening. Then, largest connected component from binarised image is selected by considering the fact that brain is the largest connected structure inside the head.

Segmentation:

Segmentation subdivides an image into its constituent regions or objects and it should stop when the objects or regions of interest in an application have been detected. Segmentation is process of partitioning the image into different parts having similar features. The pre-processing stages needs to done on the image initially, and then segmentation and feature extraction is applied for the detection of the tumor which is the region of interest (ROI) from the entire image. The features are intensity based, area base, is the vital part of segmentation as the tumor must be isolated from the brain image. For brain image segmentation numerous image processing techniques have been proposed, for example- region growing, thresholding, classifiers and clustering.



Feature Extraction

Features, the characteristics of the objects of interest, if selected carefully are representative of the maximum relevant information that the image has to offer for a complete characterization of a lesion. Feature extraction methodologies analyze objects and images to extract the most prominent features that are representative of the various classes of objects. Features are used as inputs to classifiers that assign them to the class that they represent. The purpose of feature extraction is to reduce the original data by measuring certain properties, or features, that distinguish one input pattern from another pattern. The extracted feature should provide the characteristics of the

input type to the classifier by considering the description of the relevant properties of the image into feature vectors. In this proposed method we extract the following features.

- Shape Features - circularity, irregularity, Area, Perimeter, Shape Index
- Intensity features – Mean, Variance, Standard Variance, Median Intensity, Skewness, and Kurtosis.
- Texture features –Contrast, Correlation, Entropy, Energy, Homogeneity, cluster shade, sum of square variance.

Accordingly, 3 kinds of features are extracted, which describe the structure information of intensity, shape, and texture. These features certainly have some redundancy, but the purpose of this step is to find the potential by useful features. In the next step the feature selection will be performed to reduce the redundancy. Feature selection is the technique of selecting a subset of relevant features for building robust learning models by removing most irrelevant and redundant features from the data, feature selection helps improve the performance of learning models by:

- Alleviating the effect of the curse of dimensionality.
- Enhancing generalization capability

Classification:

The SVM is a supervised learning method. It is a good tool for data analysis and classification. SVM classifier has a fast learning speed even in large data. SVM is used for two or more class classification problems. Support Vector Machine is based on the conception of decision planes. A decision plane is one that separates between a set of items having dissimilar class memberships. The Classification and detection of brain tumor was done by using the Support Vector Machine technique. Classification is done to identify the tumor class present in the image. The use of SVM involves two basic steps of training and testing.

Clustering algorithm:

K-Means is the one of the unsupervised learning algorithm for clusters. In k-means algorithm initially required to define the number of clusters k. Then k-cluster center are chosen randomly. The distance between the each pixel to each cluster centers are calculated. The distance may be of simple Euclidean function. Single pixel is compared to all cluster centers using the distance formula. The pixel is moved to particular cluster which has shortest distance among all. Then the centroid is re-estimated. Again each pixel is compared to all centroid. The process is continuous until the center coverage. K-means clustering algorithm clusters data by iteratively computing a mean intensity for each class and segmenting the image by classifying each pixel in the class with the closest mean.

Algorithm for K means Clustering:

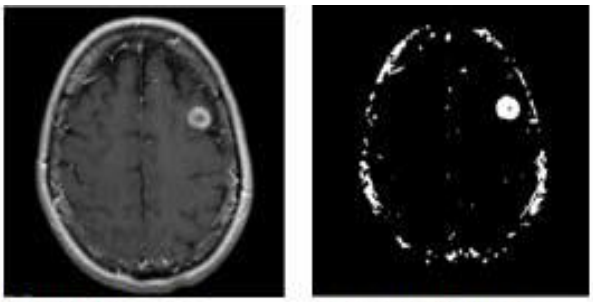
Step 1: Compute the intensity distribution

Step 2: Initialize the centers with k random values

Step 3: Cluster the pixels based on distance of their intensities from the center

Step 4: Compute the new center for each of the clusters

Step 5: Repeat the following steps until the cluster center of the image does not change anymore



Original image segmented image

Fuzzy C-Mean clustering algorithm introduced by Bezdek is an improvement of earlier clustering methods. It is based on minimizing an objective function, with respect to fuzzy membership, and set of cluster centroid. The FCM algorithm iteratively optimizes with the continuous update of fuzzy membership and set of cluster centroid. The drawback of FCM for image segmentation is the objective function of FCM does not take into consideration any spatial dependence among.

Step 1: Randomly select c cluster centers.

Step 2: Calculate the fuzzy membership function and center for each cluster

Step 3: Compute the new membership value and update fussy membership degree

Step 4: Repeat previous Step until the membership value is less than or equal to previous one.

4. CONCLUSIONS

There are different types of tumors available. They may be mass in the brain or malignant over the brain. Suppose if it is a mass, then K- means algorithm is enough to extract it from the brain cells. If there is any noise present in the MR image it is removed before the K-means process. The noise free image is given as input to the k-means and tumors are extracted from the MRI image. The performance of brain tumor segmentation is evaluated based on K-means clustering. Segmentation is done by advanced K-means algorithm and fuzzy c means algorithm.

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