An Effective & Automated MR Brain Image Segmentation & Tumor Detection

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ABSTRACT: The image processing is an interesting and challenging field now a days and medical image processing plays a major role in it. The medical images are used to analysis the diseases like brain tumor, cancer, diabetes, etc. The brain tumor is one of the dangerous diseases where many people suffer from this disease. Image segmentation is used to take out the suspicious parts from medical images like MRI, CT scan, and Mammography etc. For MRI brain image segmentation adaptive k means clustering is used. The feature extraction is done using the GLCM (Gray Level Co-occurrence Matrix) which stay away from the creation of misclustered region. The feature selection is done to improve the classifier accuracy using PCA (Principle Component Analysis). A PSVM (Proximal Support Vector Machines) classifier is used to automatically detect the tumor from MR brain image which is faster and efficient than the existing method SVM.
Keywords - Feature Extraction, Image Segmentation, MRI, Proximal Support Vector Machines

I. INTRODUCTION

The Magnetic Resonance Imaging (MRI) is usually used medical image technique which provides detailed information of the internal tissue constitutions of the image. They provide complete information about brain tumor anatomy, cellular structure and vascular supply. It provides an effective result for the diagnosis of disease provides efficient treatment and monitors the disease in an efficient manner.

The analysis of brain tumor can be examined by MRI scan or CT scan. The main advantage of MRI scan is that it does not contain any radiations, whereas CT scan contains many radiations. So that MRI does not affect the human body. MRI is better compared to CT scan. MRI is a type of scanning device, which use magnetic field and radio waves. MRI scans provide exact picture of anatomical structure of tissues. A tumor may be primary or secondary. **It'săsaidătoăbeăprimaryăifătheătumorăisăatătheăbeginningăsta**te. **It'să saidă toă beă secondaryă ifă theă tumoră hasă spreadă toă otheră** places and has grown.

The brain tumor affects CSF (Cerebral Spinal Fluid) and causes strokes. The treatment is given for the strokes rather than the treatment for tumors. So the detection of the tumor is important for that treatment. If the tumor is detected at an earlier stage the life time of the person will be increased. In image processing an array of pixels is taken as input, which produces another array of pixels as output which represents perfection to the original array. The Digital Image Processing processes the two-dimensional picture by a digital computer changing the existing image in the required manner. This process removes the noise, improves the contrast of the image, and removes blurring. If an image is low contrast and dark, the images improve its contrast and brightness. The histogram equalization improves all parts of the image when the original image is irregularly illuminated. The images contrast is increased using the enhancement techniques and also the quality of the images are improved using the image enhancement techniques.

II. RELATED WORK

The process of collection of content that provides a wide area view of the project to be taken up is Literature Survey. For thorough study of the system it needs to go through each and every technical aspect of the related material.

A. MRI over CT scan

MRIă isă usedă becauseă it'să provideă accurateă visualizeă ofă anatomical structure of tissues. The analysis of brain tumor can be found by MRI scan or CT scan. The main benefit of MRI over CT scan is, MRI does not contain any radiation. It provides accurate picture of anatomical structure of tissues. It does not affect the human body. Fundamentally MRI is better compared to CT scan, which uses magnetic field and radio waves.

B. K-Means Clustering and Fuzzy C-Means Algorithm

Tumor is an uncontrolled growth of tissue in part of the body. There are different types of algorithms developed for brain tumor detection. But there are some drawbacks in the detection and extraction. The segmentation process is done through k-means clustering and fuzzy c-means algorithms. After the segmentation process the brain tumor is detected and its exact location is identified. When comparing to the other algorithms the performance of fuzzy c-means plays the most important role. The patient's stage is identified by this **processă andă it'să checkedă whetheră ită canăbeă curedă withă** medicine or not.

C. Image Enhancement

Image enhancement is used for the purpose of image processing. To improve the digital image quality image enhancement is used. Image histogram is used in image enhancement. The histogram in the framework of image processing is the operation by which the occurrences of each intensity value in the image is shown and histogram equalization is the method by which the dynamic range of the histogram of an image is increased.

D. Image Segmentation with Non Negative Matrix Factorization

Nonnegative Matrix Factorization is one of the techniques to reduce the dimensionality of the data. NMF is used for the image processing methods such as pattern analysis and text mining. **It'să** used as an uninterruptable decomposition approach for detection of tumor and for further classification and for feature extraction. NMF finds two non-negative matrices where the product closely approximates the original matrix. NMF contains all matrices that contain only non-negative elements.

E. MRI Brain Image Classifications

It presents the techniques for the classification of the magnetic resonance images (MRI). There are three stages in the technique, which are feature extraction, dimensionality reduction, and classification. In the first stage, the features related to MRI images are obtained using discrete wavelet transformations (DWT). In the second stage, the most essential features of the magnetic resonance images have been reduced, the reduction is done using principal component analysis (PCA). For classification two classifiers are used. The first classifier is based on the feed forward back propagation artificial neural network (FP-ANN) and the second classifier is based on the k nearest neighbor (k-NN). The classifiers are used to classify the MR images as normal or abnormal. The classification is obtained with a success of 97% using FP-ANN and success of 98% using k-NN. It shows that the technique is robust and effective compared with other works.

III. SYSTEM ARCHITECTURE

The proposed architecture gives an efficient way to detect the tumor with a high accuracy. The architecture has two phases training and testing, in training the MRI brain image is done with pre-processing, segmentation, feature **extraction,ă featureă selectionă andă it'să storedă ină theă hospitală** database. Some of the sample images are taken from the database and testing is performed. In testing phase a query **imageă(MRăbrainăimage)ăisătakenătoăfindăwhetherăit'sănormală** or abnormal. The query image will also undergo pre-processing, segmentation and feature extraction with new technologies. Once feature extraction is done the image is classified using PSVM classification, the classification done through PSVM gives the high accuracy detection compared to SVM. The tumor type is declared in the results.

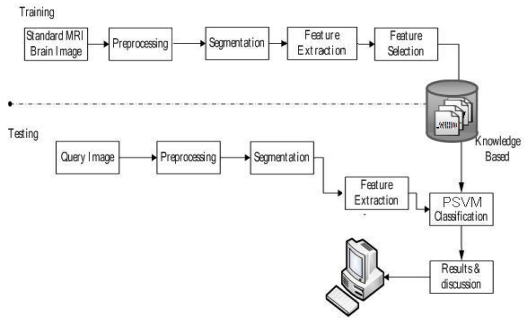

Figure 1: Brain Tumor Diagnosis System

In existing system, the system uses different segmentation methods. They use clustering algorithms like fuzzy c means, k means which has more disadvantage than the proposed system. For segmentation the existing system uses k means algorithm, where it has some disadvantages. To overcome the disadvantages, an adaptive K-means clustering algorithm (AKM) is proposed in this system. In existing for tumor classification the system uses SVM (Support Vector Machines). This is very slow process and complex when comparing the proposed system. The accuracy rate and precision rate is very less when compared to the proposed system.

IV. IMPLEMENTATION

The brain tumor diagnosis system is implemented using matlab. The brain MR image is taken and the following processes are done one by one to detect the tumor type. The processes are:

i. Image Pre-processing
ii. Segmentation
iii. Feature Extraction
iv. Image Classification

Image Pre-processing

Image pre-processing is performed to remove noise and clean up the image background, suppresses unnecessary distortions or enhances some image features important for further processing. Adaptive filters are used for image pre-processing where it can complete some signal processing tasks that traditional digital filters cannot.

Segmentation

Segmentation is the process of dividing an image into regions with similar properties such as contrast, color, brightness, gray level, color, and texture. Gray scale image is obtained from the color image. Adaptive k means clustering algorithm is used for the segmentation process. Tumor regions are effectively segmented by adaptive k means clustering algorithms and thus the tumor portion from MRI image is detected.

Feature Extraction

In feature extraction the texture feature is defined by using Gray Level Co-occurrence Matrix (GLCM). The important features for brain tumor recognition like contrast, homogeneity, energy and entropy are extracted using GLCM. The features extracted gives the property of the texture, and are stored in knowledge base and further compared with the features of unknown sample image for classification. The texture features of the MRI brain images are used to classify the tumors.

Image Classification

For automatic detection of tumors at a faster rate, PSVM (Proximal Support Vector Machines) is used as the classifier for brain image classification using matlab with GLCM.

PCA (Principal Component Analysis) is used for feature selection, which is used for improving the detection accuracy. Using the features extracted with GLCM the PSVM classifier classifies the tumor type.

V. CONCLUSION

The effective segmentation and classification is proposed using adaptive k means and PSVM. After segmentation, feature extraction is performed using GLCM, and then the images are classified using PSVM classification and feature selection using PCA. At the training phase of PSVM, the texture features are utilized which can reduce the computation complexity of PSVM classifier. The result shows that the proposed system shows a high accuracy rate and less error rate. In future the system can be improved to support other types of cancer images. It is necessary to support large number of input and should improve the accuracy rate. To achieve this more number of features can be added with the utilization swarm based feature selection to improve the tumor detection and the classification result.

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