

Tumor Detection and Classification of MRI Brain Image using Support Vector Machine (SVM)

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Abstract: Brain is one of the most complex organs in the human body that works with billions of cells. A cerebral tumor occurs when there is an uncontrolled division of cells that form an abnormal group of cells around or within the brain. This cell group can affect the normal functioning of brain activity and can destroy healthy cells. Brain tumors are classified as benign or low-grade and malignant tumors or high-grade. Benign tumors are non-cancerous tumor and they do not spread to other tissues or organs. Malignant tumors are cancerous tissue and they can easily spread to other tissues or organs. Proposed system is to differentiate between normal brain and tumor brain (benign or malign). Also, the proposed system predicts brain tumor from MRI image classification system is based on extracting useful MRI features for diagnosing the medical MRI images. The benefits of using SVM is nevertheless of the image brightness or rotation of the MRI image, it also provides huge number of strong features that can be automatically prepared well to be suitable for MRI classification. Support Vector Machine (SVM) algorithm is used to predict the diseases accurately from MRI (Magnetic Resonance Imaging) scan images. SVM algorithm is the used for the purpose of classifying the image datasets and to predict the disease by itself for those matching the images to enhance a comprehensive set of quantitative measurements among several influential on various brain image databases.

Keywords: Brain tumor, uncontrolled division of cells, Benign and malignant tumor, Support Vector Machine (SVM) algorithm.

I. INTRODUCTION

MRI is a widely utilized method which works with the analysis and recognizing of cerebrum tumors in numerous neurological sicknesses and conditions. Standard MRI arrangements are of the most part used to separate between various kinds of brain tumors dependent on visual characteristics and difference surface investigation of the delicate tissue. In excess of 120 classes of cerebrum tumors are known to be arranged in four levels as per the level threat by the World Health Organization (WHO). The evaluating from low to high (1-4) are dangerous levels from the most unforceful natural tumor to the most forceful tumors, as explored for instance, vascularity, intrusiveness, and tumor development rate. Gliomas are the most essential cerebral tumor and a pretreatment assessment grade is important; be that as it may, the restrictive utilization of standard MRI groupings might be inadequate for an exact analysis. Literature survey has revealed that some of the methods are discover for segmentation only; some of the methods are discovered to obtain feature extraction and some of the methods are discovered to obtain classification only.

II. LITERATURE SURVEY

Ujwala sane developed a system by using random forest and KNN algorithm for segmentation and for classifying the MRI images system was made up with two systems such as discrimination and randomization. Discrimination refers to the need of SVM to learn itself the classification for each node and randomization as a form to learn the futures of the classified nodes. Also, in the developed system pre-processing consists of a series of steps including baseline adjustment by enhancing group median, smoothening the images to delete the noise with the help of Gaussian kernel and normalization has been performed to make it in similar [1]. Gini Garg et. al. proposed a hybrid based classifier

ensemble model by combining the random forest, K-Nearest neighbour and decision tree algorithms for classifying the MRI images. Segmentation has been carried out by using Otsu's threshold method and feature extraction has been done by using stationary wavelet transform, principal component analysis and grey level co-occurrence so that it can accuracy of classification [2]. Muhammed Oguz TAS et. al used traditional deep learning methods and used K-means algorithm for segmentation to determine the exact location of tumor from MR images. However, experiment works with the training process of taking 9 minutes and 32 seconds [3]. Akila Gurunathan et. al. works on automated computer aided method for recognizing brain tumors by using Convolutional Neural Network (CNN). In the stage of preprocessing image resolution is converted into 256*256 pixels and cnn architecture system requires a large number of images during training process on account of to increase the classification accuracy [4]. Ghazanfar Latif et. al. most of the deep learning based detection uses back propagation algorithm to recognize data abstraction in an multiple abstraction layers. Raw inputs are transformed from a non-linear module into a high level module characterization at every individual level. This function will be widely used in the most frequent neural networks. CNN are able to process different kinds of images and signal data into multiple dimensional arrays. Two layers are able to perform the neural network the layers are convolution layer and the pooling layer. Units of convolution layer are able to makeup that can be referred to as feature maps and the feature maps of one layer will be able to makeup what can be referred as feature maps. Feature maps of every layer will be connected to the feature maps of the previous layers with the help of filter banks. Filter banks can be considered as a weighted matter as it helps to connect with the previous layer [5]. Amjad Rehman et. al. works on fully automated 3D CNN based model that can segment automatically and the process has been carried out in three stages such as new CNN framework for brain tumor extraction, pre-trained VGG19 based analyzed features extraction and pearson correlation for end feature selection [6]. Lenhard Penning et. al. made a comparable segmentation of tumor detection to overcome the high complex tasks while segmenting the MRI images [7]. Aswani Santhosh demonstrated a method for separating the tumor part in the image with the enhancement of threshold image that will be helpful to convert the gray scale image into binary image. Also, the process is to identify the nonlinear operation which is connected to the morphological operation. Morphological operation creates a new binary image for the pixels having a non-zero value whether the test is successful to locate for that particular image [8]. MD Shahariar alam et. al. used K-Means clustering algorithm which is an unsupervised learning algorithm. This algorithm is highly used to cluster the set of data. K-clusters should be selected randomly. Distance has been calculated by the available techniques such as Euclidian distance, Manhattan distance, Chebychev distance and many more. Choosing the right technique is need of the K-Means algorithm. Furthermore, Fuzzy C-Means algorithm has been used to process with every pixel of data to belong with two or more clusters [9]. Milica M. Badza et. al. developed a framework for classifying the brain tumors using a T1-weighted contrast enhanced MR images and the whole image has been taken as input whereas it was not able to perform any preprocessing or segmentation of the tumor [10]. S. Jayaprada et. al designed a model with fast Adaboost binary classifier an ensemble model approachment with the pre-trained dataset to analyze the various problem in which it tends to proposes a way for more than one application of feature extraction to provide a classification model to identify various brain tumors in order to increase the various parametric values for every trained and tested datasets [11]. Leu Guo et. al. works founded a solution on how to handle with a non-linear distribution of real time data by using one class SVM algorithm and algorithm's kernel function helped to achieve the classification result. At, the initial stage work has been carried out with Immune Algorithm (IA) on account of searching the optimal feature weighted parameters at the same time and also proved that one-class immune feature weighted SVM has a better performance while comparing to the one-class SVM [12]. Nilish Bhaskarrao bahadure et. al. skull stripping is the most important process to be held on biomedical image analysis. Skull stripping also helps to remove unwanted cerebral tissues. Wavelet function is to be mentioned by setting an average value to be zero. Morphological operations can be used for extracting the boundary regions of the brain images. Morphological operations can be used only arranging the pixels in a sequential order with the relative pixels so that it easy to process only on brain images. Basic operations to be held on morphological operations are the dilation and erosion. Dilation will be occurred on intended to add pixels to the objects on the boundary regions and erosion will be occurred to remove the pixels from the object on the boundary regions [13]. Ayse Demirhan et. al. S. Madhukumar

et. al. works on to evaluate the ability of applying fuzzy C-means and K-Means algorithms to segment the grey and white matter of the images [14].

III. METHODOLOGY

The main purpose of this project is to identify the tumor and to classify the MRI images using SVM (Support Vector Machine) algorithm. Hence, pre-processing is performed to de-noise (removing noises) from the MRI brain images. However, brain MRI contains extra-cranial tissues such as bone, skin, air, muscles needed to be removed so that the heterogeneous tissue images will be converted into a homogenous tissue image. Median filters can be applied to remove noise from the images however; sometimes tiny changes can be made on the images. An automatic segmentation of tumors sometimes can become more critical because of variations occurring in the texture, intensity, shape and size. Proposed system is used to detect all the brain cell related diseases. This problem will be overcome in the proposed system. Also, the proposed system helps to predict the disease within a less computation of time. Proposed system follows the following modules such as data acquisition, pre-processing, segmentation, classification and feature extraction.

IV. MODULES

4.1 Data Acquisition

A dataset are procured for exploratory assessment. It comprises of 100 MRI images, out of which 80 images have tumor and the excess 20 are ordinary. The size of each picture is 512 x 512 having DICOM (Digital Imaging and Communications in Medicine) format. The dataset comprises of multi-contrast MR filters.

4.2 Preprocessing

Preprocessing of MRI images has been carried out into two stages such as de-noising the MRI image and skull masking. Median filter is applied to de-noise the MRI images as to convert the RGB image into grey-scale image and in addition to improve certain parameters such as smoothing the inner parts of the region and preserving its edges. Skull masking is a process in which it can perform on de-noised image. Main purpose of this process is to remove the unwanted fatty tissues such as skull part and hair part of the MRI so that it is very much easy to carry on the process only with brain tissues and reducing the ambiguity of identifying tumor tissue.

A. Steps to be Followed for Preprocessing

1. RGB image is converted in the form of grayscale.
2. High pass filter is to be applied so as to reduce the noise on brain MR image.
3. To detect the edges high pass filter mask is passed to the obtained image. It is necessary to pass the high pass filter. After that, original image will be added by the edge detected image as to obtain the enhanced image. However, median filter can tend to modify the damaged image with the help of intensity of ruined image to preserve the localization details.

4.3 Segmentation

Segmenting an image is one of the most critical tasks in advanced image analysis, major key purpose of image segmentation is to partition an image into various regions and objects in which it can cluster (group) themselves simultaneously. If the pixel value reaches more than the threshold value then it is mapped to be white, whereas other pixels are mapped as black. Because, of this two different regions can be formed around the affected tumor tissues, which will be easily cropped out. To increase the dynamic range of histogram for an image histogram equalization technique can be applied. Advantage, of using histogram technique is it can assign the intensity values to the images. It is very much known that utilization can be occurred only on features of the texture or else it can be done on by a combination of texture and shape for MRI brain classification. At last, the gray scale picture is changed over to one or the other black or white called binary image is done based on some threshold value.

4.4 Classification

Support Vector Machines (SVM) Support Vector Machines is normally used for classifying the given data. It comes under the category of supervised machine learning technique. Support Vector Machines separates the data into different classes of n-dimensional Euclidean space. The n-dimensional Euclidean spaces are known as support vectors in which it is easy to predict and classify the upcoming data points from the datasets. By using SVM algorithm image in DICOM format is converted into JPG format. SVM is used to split a set of images into two various classes. The classification is done by finding the hyper-plane that differentiates the two classes. It builds a hyper plane based on a kernel function. Feature vectors on left side of hyper plane belong to class -1 and the feature vectors on the right side of hyper plane belong to class +1. In neural network, the dataset of MRI images are trained as iteration method. Therefore, when a new image is given to the neural network, it will be trained by neural network by comparing the iteration value of the previously trained image.

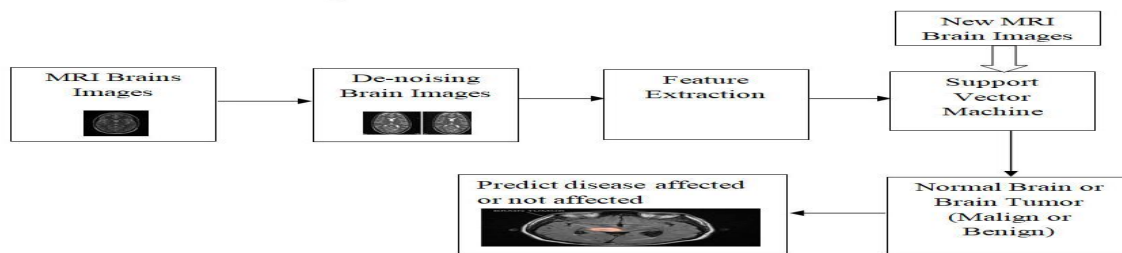


Figure 1: Architecture diagram

4.5 Feature Extraction

Feature extraction is the next process to be done after reducing the noise in the MRI images. As to predict the disease accurately from MRI images at the brain whether tumor is affected or not it is necessary to remove the average pooling layers from the pre-trained model and add an auxiliary convolution layers for the purpose of predicting the disease is presented or not.

V. CONCLUSION

In this paper, it has been used brain MR images, segmented into normal brain tissue (unaffected) and abnormal tumor tissue (infected). In order to remove the unwanted tissues median filters are applied so that it is very easy to convert the RGB image into gray scale image and to remove unwanted tissues. Biggest advantage of removing unwanted tissues it helps to smoothen the inner parts of the image. Segmentation is performed to split up the image and to group. SVM algorithm is used for the classification of tumors from brain MRI images. Also, the proposed method is effective and efficient in predicting malignant and benign tumors from brain MRI images. It aims to results in accurate and fast detection of tumor in brain along with identification of precise location of the tumor.

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