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Detection of Brain Tumor Using Image Processing

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ABSTRACT

Brain tumor is an accumulation of anomalous tissue in the brain. Tumors are primarily classified into malignant and benign when they develop. It can be life threatening hence it is important to recognize and identify the presence of tumors in brain image. This paper proposes a system to decide whether the brain has tumor or is it tumor-free from the MR image using combined technique of K-Means and support vector machine. In the first stage the input image is converted to grey scale using binary thresholding and the spots are detected. The recognized spots are represented in terms of their intensities to distinguish between the normal and tumor brain. The set of feature extracted are later characterized by using K-Means algorithm, then the tumor recognition is done using support vector machine.

Keywords: K-Means, support vector machine, malignant, benign, computerized tomography (CT), magnetic resonance imaging (MRI)

1. INTRODUCTION

Brain tumors are frequently referred to as cancerous also termed as malignant or noncancerous termed as benign [1] cells in the brain. Tumors can likewise be primary or secondary [2]. The benign tumors are not as aggressive as malignant tumors i.e. the mass or development of unusual cells does not contain cancer cells. These tumors develop gradually and tend not spread into other tissue. The threatening mind tumors contains malignant growth cells and furthermore be likely not to have clear fringes. These tumors are seen increasingly hazardous as they grow rapidly and can attack different pieces of the cerebrum. Doctors may likewise allude to a tumor dependent on where the tumor cells began. In the event that the tumor started in the mind, it tends to be named to be an essential cerebrum tumor. In the event that it started in another piece of the body and spread to the mind, it very well may be alluded to as an auxiliary (metastatic) cerebrum tumor. In the date of ninth May 2016, the world wellbeing organization (WHO) definitively renamed the majority of the sorts of cerebrum tumor. The American Cerebrum Tumor Affiliation (ABTA) gauge that there will be in excess of 79,000 new instances of essential mind tumors analyzed in the US in 2017. In any case, they have assessed that around 33% of these will be threatening. ABTA inexact that there are right now around 700,000 individuals living with essential mind tumors in the U.S. As indicated by ABTA, an expected 16,700 individuals will kick the bucket from mind and spinal string tumors in 2017. A wide range of cerebrum tumors may create side effects that differ contingent upon the piece of the mind included. A specialist plan tumor assessment relying upon

- CT filter: A mechanized tomography (CT) examine produces a nitty gritty X-beam image of a patient's mind [3].
- MRI filter: Attractive reverberation imaging (X-ray) utilizes a solid attractive field and radio waves to deliver a point by point picture of the mind [4].
- EEG: An electroencephalogram utilizes terminals appended to the head to record cerebrum action looking for variations from the norm [5].

The diagnostic images of above methods are used in detection of brain tumor. There are many types of software and applications available to reduce human effort. The main objective in brain tumor detection is to detect the presence of tumor and to calculate the area of tumor spread that is detected.

In this paper, MRI images of the brain is used as input, because these images provide a details of infected and the non-infected tissues. The next

process is detecting the spots in the images such that it differentiates between the tumor's part and the rest of the brain. The method used for this purpose is setting a value[6] such that if the value is lower than matching value then that part is not affected and if a value which is greater or equal to matching value then that part is affected by the tumor. Then we need to obtain clusters so that we can clearly distinguish between the tumor and the non-affected part of the brain. To achieve this the method used is K-Means clustering algorithm. Next support vector machine is used to analyze the data to identify type of cancer.

The paper focus on detection of brain tumor using image processing from the MR Image using K-Means clustering algorithm. The detected tumor is then classified using SVM classifier. The main purpose of this paper is to detect the tumor present, the total area spread of the tumor if present and classify it into types. The proposed system is helpful in automated detection of brain tumors. In this system, we use combination of K-means which is a clustering algorithm and support vector machine(SVM) which is a machine learning method. The system helps in faster detection of the tumors and provides accurate results with low training set.

The rest of the sections in this paper as follows: section II provides related works on tumor detection. The section III explain proposed architecture. The results of proposed system are discussed in section IV and finally summarization and conclusion of the paper is discussed in section V.

2. LITERATURE SURVEY

Praveen et. al. [7] used combination of fuzzy C-Means(FCM) and SVM system with data mining methods for detecting brain tumor from an MRI image. The MRI image scans are improved using enhancement methods contrast enhancement and middle-range extension. Later double threshold with morphological operations are applied for skull stripe. Then FCM clustering is applied for segmentation and detection of the suspicious region. Grey level run length matrix(GLRLM) is used in acquiring feature from the brain image, then SVM technique is in to classification of brain MRI images. Shruthika Santhosh et.al.[8] applied thresholding and morphological operations in detecting brain tumors. The size with stage of tumor is detected using database systems method. The MRI image is converted into grayscale and these images have brightness information of the MRI images. The grayscale image is filtered using high pass filtration for filtering unnecessary noise. Thresholding method is used to extract the objects from background of the MRI image. later morphological operations like dilation and erosion are applied. Dilation combines two sets using vector addition whereas erosion combines two sets using vector subtraction. Tumor detection is completed by applying the thresholding method. Calculation of area of tumor is done for detecting the stage of tumor of the patient.

Hayder Saad Abdulbaqi et.al.[9] proposed detection brain tumor in magnetic resonance images using hidden markov random field and threshold method. The images from MRI scans are converted into 2D images. Segmentation of images with assigning a label is helpful in detection of boundaries of an object and help in analyzing the growth of the tumor. Here a pixel threshold value is set and in the images the pixel value which is lesser than the threshold will be black and the rest whose threshold value is greater the set threshold value will be having a different color. This is helpful in detecting the brain tumor. Manisha et.al.[10] proposed extraction of tumor region by extracting edges in brain MRI images. This technique uses edge detection method in detection of brain tumors from MRI images which are very accurate. MRI is a 2D image if the image is a color image then it is converted to grey. Preprocessing is performed to remove the noise in the image using median filter. The detection of the tumor is done for the processed image after median filter, then standard deviation of the image is computed. Later intensity map is set depending on standard deviation. Then unwanted objects are removed from the image and then computed the pixel area of the objects in image if the value is greater than predefined value then tumor is detected. Dilation is done to fill the holes in the image. Border detection of the tumor is done using sobel filter, sobel filter determines the edges using the derivative images.

Navpreet Kaur and Manvinder Sharma [11] proposed mind tumor location utilizing self versatile K-Means grouping. The cerebrum X-ray pictures demonstrate an unpredictable system of synapses alongside hard structures and suspected strong growth(if present). Accordingly, so as to remove the development, a division procedure is required. In unique K-implies calculation, the quantity of bunches are characterized by the client for example client information is required. In any case, this impediment is overwhelmed by utilizing the self-versatile K-implies bunching calculation to recognize cerebrum tumor precisely. A sobel edge location strategy[12] is pursued to extricate the edges of the fragmented cerebrum tumor from its environment. In self-versatile k-implies bunching, the quantity of groups are registered by figuring the tops in histogram. The dim variant is utilized to remove textural and shading based highlights for nature of development examination. Self-calculation estimation of 'k' for example number of bunches is registered by

histogram of the picture under test where Histogram of picture is separated. The dark shading histogram gives the most extreme pinnacle shading powers present in the picture. Concentrate the histogram tops with counter to get the estimation of 'k' as number of bunches. The displayed work identifies the mind tumor development in each cut of the X-ray picture. Self-versatile k-implies grouping gives the client a choice to choose number of bunches. As it's a hard to judge physically precisely what number of bunches ought to be or can be there in the picture and furthermore it differs from individual to individual. In this way, in view of nature of picture as far as its histogram, the quantity of groups might be registered. Further, the sobel edge[13] indicator limits the development in a limit from where size estimation should be possible.

3. PROPOSED ARCHITECURE

The algorithm of proposed architecture is as shown below:

Algorithm:

Input: MR Image selected by user.

Output: Report generated after the detected tumor is classified.

Step 1: The selected MR Image is pre-processed using Binary Thresholding.

Step 2: The pre-processed image is then subjected to K-Means clustering.

Step 3: If tumor is not detected the user is notified that there is no tumor present, else if the tumor is detected then further classification of tumor is done using SVM Classifier.

Step 4: After classification is done then report is generated and is displayed to the user.

The implementation approaches of the proposed system are as follows:

Magnetic Resonance Image: In this paper, we are using MR Image as input. MR Image is a grey scale image. It uses strong magnetic fields and radio waves to generate images of the organs.

Binary thresholding: We use Binary thresholding improve the quality of the MR image. The value of each pixel will be in the range 0 to 255, here we are using threshold value calculated using[6]. The pixel value below this threshold will be changed to black, and above will be changed to white.

K-Means Clustering: K-means clustering is used to cluster the pixels with similar properties. After clustering we can decide whether there is a tumor detected or not.

SVM Classifier: To determine the type of tumor, SVM Classifier is used. This classifies two different types of tumor, benign and malignant depending upon the area of tumor affected.

Architectural design of proposed algorithm for detection of brain tumor using image processing is shown in figure 1 and 2.

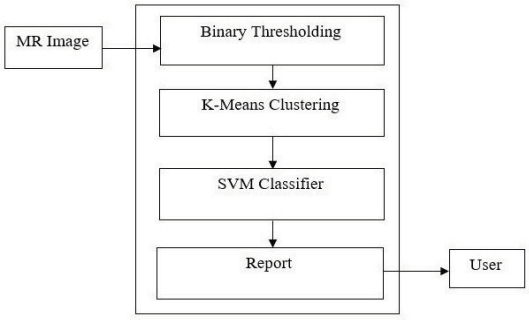

Figure 1: Architectural design

The system inputs magnetic resonance image as an input for detection of tumor. Later it further classifies the tumor into malignant and benign based on the size of tumor present.

MRI images of the brain is used as input, these images contain details of infected and the non-infected tissues. The next process is preprocessing which helps in detecting the spots in the images such that it differentiates between the tumor's part and the rest of the brain. The method used for this purpose is setting a value (Threshold value) such that if the value is lower than matching value then that part is not affected and if a value which is greater or equal to matching value then that part is affected by the tumor. Once tumor is detected then we distinguish between the tumor and the non-affected part of the brain for that clustering is applied with which we clearly distinguish between the tumor and the non-affected part of the brain. To achieve this the method used is K-Means clustering algorithm. Next support vector machine is used to analyze the data to identify type of cancer.

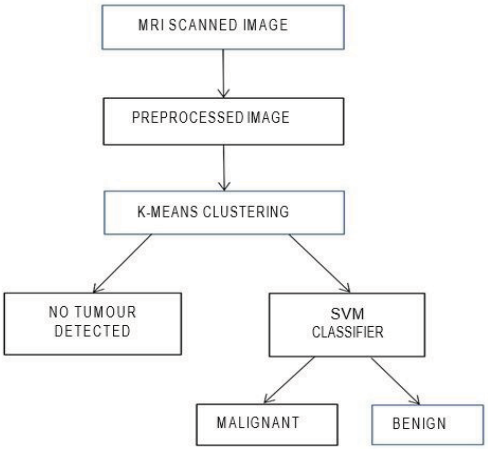

Figure 2: Modular design of proposed architecture

The primary focus is detection of brain tumor using image processing from the MR Image using K-Means

clustering algorithm. The detected tumor is classified using SVM classifier. The main purpose is to detect the tumor presence, then compute the total area spread of the tumor if present and classify it into types. The proposed system helps in faster detection of the tumors and provides competitive results with low training set.

The module designed are:

- Binary Thresholding
- K-Means clustering
- SVM classifier and Report.

The MR image is received as an input and sent to the system which consists of these modules and then result is displayed to the user.

RESULTS AND DISCUSSIONS

Graphical user interface is shown in figure 3. The text on screen explains about implementation method. The figure shows the user interface through which the user selects the specific MR image of the patient.

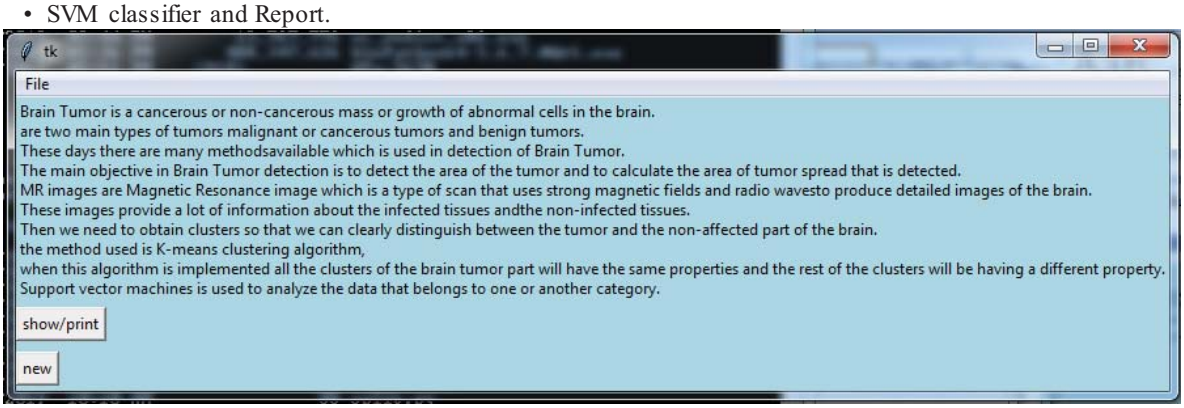

Figure 3: GUI for user input

The user input for experimentation is shown in figure 4. The test images for experimentation are taken from[14]. The sample result of preprocessing is shown in figure 4 along with its original input.

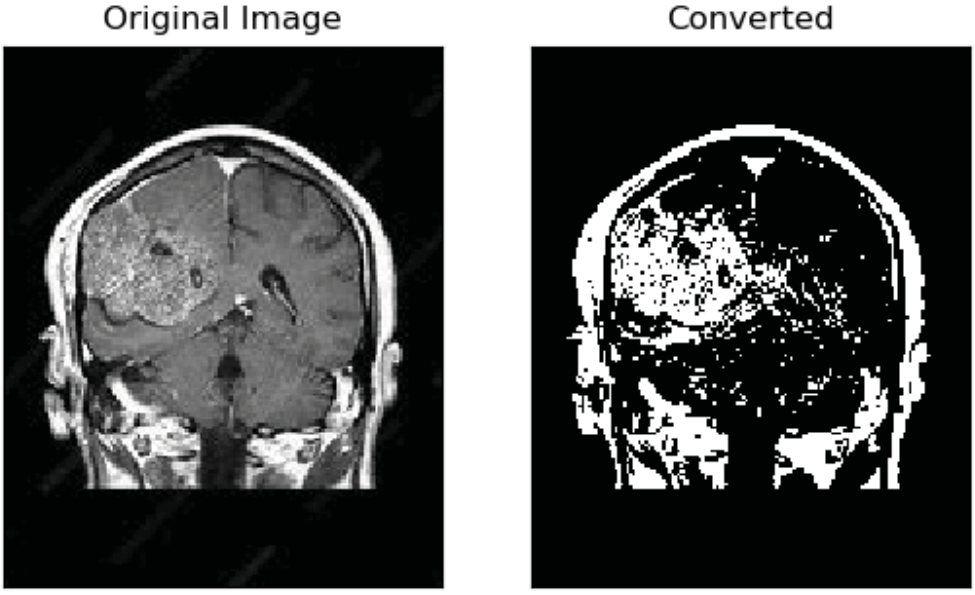

Figure 4: Original and preprocessed versions of sample input image.

The figure 5 is the output of the preprocessed versions of sample input image which will have details like amount of area affected and type of the tumor detected. The experimented system requires less training set and helps in faster detection of the tumors and provides accurate results.

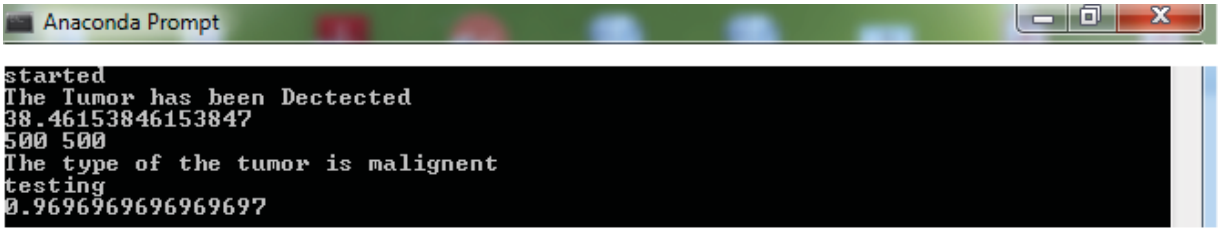

Figure 5: Output of the preprocessed versions of sample input image.

CONCLUSION

In this paper detection of brain tumor using image processing is proposed. The proposed system is helpful in detection of brain tumors automatically. Here we applied hybrid techniques K-means which is a clustering algorithm and Support Vector Machine(SVM) which is a machine learning method. The K-means is applied on the extracted features from the image by clustering the spots and later machine learning technique Support Vector Machine(SVM) to effectively applied. This system identifies the abnormalities in the brain which is detected in the MR image. The system requires less training set and helps in faster detection of the tumors and provides accurate results. The proposed system is built using Python programming.

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