Brain tumor detection based on Support Vector Machine and FBB algorithm

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Abstract : The aim of this paper is to represent an algorithm for automatic detection of tumor in brain from MRI images. Tumor is an abnormal mass of tissue within which some cells grow and multiply uncontrollably. Brain tumor detection using image segmentation is a challenging problem in field of computer vision and image processing because of the diverse image content, non-uniform object texture, image noise and other factors. According to the most research it is observed that due to late or inaccurate detection of tumor the number of people who has brain tumor died. So, the early detection of tumor can be helpful in curing of the disease. It can also be helpful in predicting whether the detected area in MRI image is part of tumor or not. If it shows increasing dimension or growth of the cells then can be predicted as tumor. Accurate detection of size and location plays very vital role in the diagnosis of brain tumor. This paper presents an associated algorithm for a technique that is employed for automatic detection of brain tumor in MRI images.

IndexTerms - **Brain tumor, Image processing, Support vector machine, Magnetic resonance imaging**

I. INTRODUCTION

Brain tumor is also known as intracranial tumor. It is an abnormal mass of tissue in which the cells grow and multiply uncontrollably. The skull surrounds the brain, which is very rigid. Any growth inside such space can cause serious problems. Brain cancer can be of two different types cancerous (malignant) or non-cancerous (benign). When the tumor grows, it can cause the pressure inside the skull to increase. This can cause brain damage. And it can also be life-threatening. Early detection and its prevention plays a very important role in reducing deaths caused by brain tumor.

A Magnetic Resonance Imaging (MRI) is a type of scan that produces pictures using radio waves and magnetism. The MRI scanned images are more preferred as compared to other imaging technique. MRI scans are very helpful in diagnosing a brain or spinal cord tumor. It can help to find where the tumor is and whether it has spread.

The Fast Bounding Box is an approximate segmentation technique which explores the symmetry of brain structure to locate a bounding box around the tumor for finding the exact position of it.

Here, the techniques used is Fast Bounding Box (FBB) which helps to find the exact location of the tumor and Support Vector Machine (SVM) is used for classification purpose which can extract tumor from skull part of brain.

II. LITERATURE REVIEW

KNN is the simple method which required low computational cost. An automatic medical image classification technique KNN classifier is used to classify the medical image into normal and abnormal image this concept Presented by R. J. Ramteke et al.[2]

P.Vasuda and S.Satheesh [6] proposed a technique to detect tumors from MR images using fuzzy clustering technique. This algorithm uses fuzzy C-means but the major drawback of this algorithm is the computational time required.

Deepa and Arunadevi [4] have proposed a technique of extreme learning machine for classification of brain tumor from 3D MR images. This method obtained an accuracy of 93.2%, the sensitivity of 91.6%, and specificity of 97.8%.

Sachdeva et al. [3] have presented a multiclass brain tumor classification, segmentation, and feature extraction performed using a dataset of 428 MR images. In this method, authors used ANN and then PCA ANN and observed the increment in classification accuracy from 77% to 91%.

Kumar and Vijayakumar [6] introduced brain tumor segmentation and classification based on principal component analysis (PCA) and radial basis function (RBF) kernel based SVM and claims similarity index of 96.20%, overlap fraction of 95%, and an extra fraction of 0.025%. The classification accuracy to identify tumor type of this method is 94% with total errors detected of 7.5%.

Sharma et al. [7] have presented a highly efficient technique which claims accuracy of 100% in the classification of brain tumor from MR images. This method is utilizing texture-primitive features with artificial neural network (ANN) as segmentation and classifier tool.

Alfonse and Salem [1] have presented a technique for automatic classification of brain tumor from MR images using an SVM based classifier. To improve the accuracy of the classifier, features are extracted using fast Fourier transform (FFT) and reduction of features is performed using Minimal Redundancy-Maximal-Relevance (MRMR) technique. This technique has obtained an accuracy of 98.9%.

III.METHODOLOGY

The MRI images are more preferred type of images as compared to other imaging technique. Here MRI brain images for are chosen from stored database. The implemented model mainly contains four steps:

1) Image Acquisition
2) Pre-Processing
3) Fast Bounding Box algorithm
4) Support Vector Machine technique

Details of the steps are presented below:

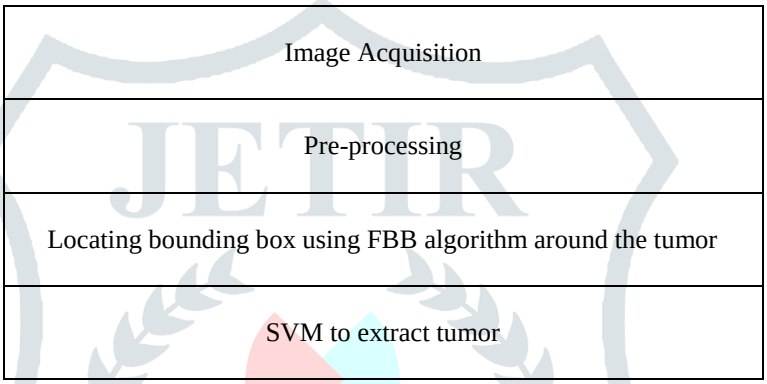

Figure 1 Schematic of proposed methodology

A. Image Acquisition:-

Image Acquisition is the first step in the image processing technique. Image Acquisition is defined as the action of retrieving an image from some sources. There are different brain imaging modalities like MRI, positron emission tomography (PET), diffusion tensor imaging (DTI), computed tomography (CT) and single photon emission computed tomography (SPECT). There are some advantages of MRI over other imaging modalities are its excellent discrimination of high spatial resolution of soft tissues. MRI provides rich information about anatomical structure [12].

B. Image Pre-processing:-

In this step the image are processed to enhance their quality by applying filtering technique. This step involves filtering of noise and other important changes in the images and edge sharpening. The input here is taken as he MRI images which also contains noise that must be removed for further process. There are several methods for removing noise, including: Gaussian filter, contourlet transform approach and wavelet thresholding approach, median filter, anisotropic diffusion filter [11].
In the proposed method the Anisotropic diffusion filter is used for removing the noise and filtering. It is proposed by Persona and Malik and it is also called as Perona-Malik diffusion. It's a technique for reducing image noise without removing the significant parts of the image content, typically lines, edges or other details that are important.

C. Fast Bounding Box Technique:-

In each input MRI slice an axial view of image is provided. There is a left–right axis of symmetry of the brain image. An abnormality that is found in the brain is called tumor typically perturbs this symmetry. Thus on the right side an axis-parallel rectangle that is from its reflection about the axis of symmetry on the left side is dissimilar, hence the gray level intensity histograms of the inside of the two rectangles are most dissimilar and the outside of the rectangles are similar accordingly [12].
The used function in this technique utilizes and identifies the region of change with two very rapid searches along the horizontal and vertical direction of the brain image [9].
Bhattacharya coefficient (BC) measures similarity between two normalized gray level intensity histograms. When two normalized histograms are the same, the BC between them is 1 and when two normalized histograms are completely dissimilar, the associated BC value is 0 [11].

D. Support Vector Machine:-

Support Vector Machines is a learning method that was first proposed by Vapnik. SVM is classification algorithm for analyzing high-dimensional data, and has the ability to learn the nonlinear distribution of the real data without using any prior knowledge [10]. It has recently gained eminence in the field of pattern classification and machine learning. By realizing a linear or non-linear separation surface in the input space classification is achieved [8].

SVM is a fast iterative algorithm for identifying the Support Vectors of a given set of points. This algorithm works by maintaining a candidate Support Vector set and uses a greedy approach to pick points for inclusion in the candidate set. Because of other points already present in the set the addition of a point to the candidate set is blocked hence it uses a backtracking approach to prune away such points. To speed up convergence with the nearest pair of points from opposite classes support vector machine algorithm initializes. Then uses an optimization based approach to increment or prune the candidate Support Vector set [8].

IV.RESULT ANALYSIS

The result is shown by first taking the input image from the database. Magnetic resonance image is selected as input. The figure 2 shows input image and the filtered image.

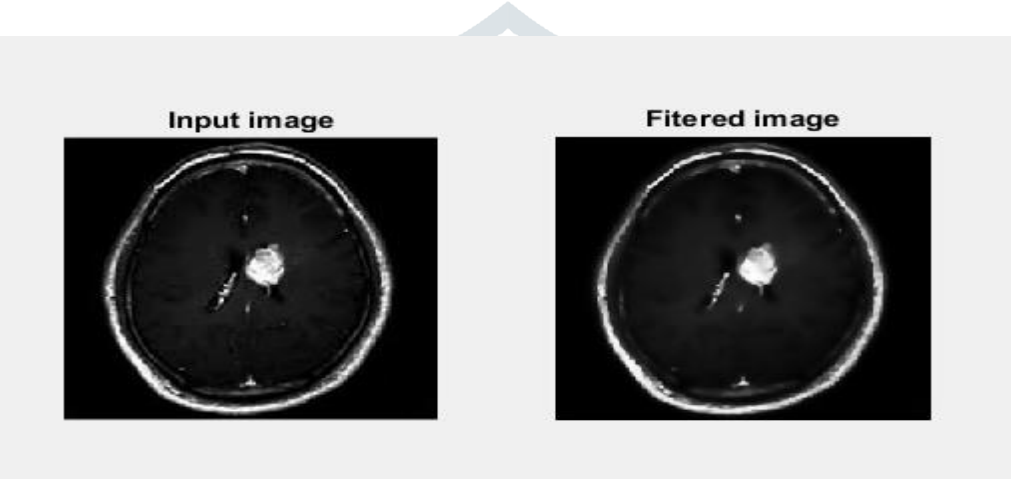

Figure 2

. Figure 3 shows the bounding box around the tumor to locate the exact position of the tumor in the brain. And finally figure 4 shows the application of the SVM technique to extract the tumor. And finally the extracted tumor and its exact location is shown as segmented tumor.

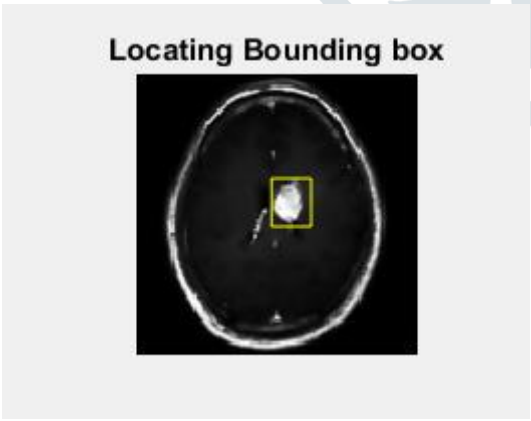

Figure 3

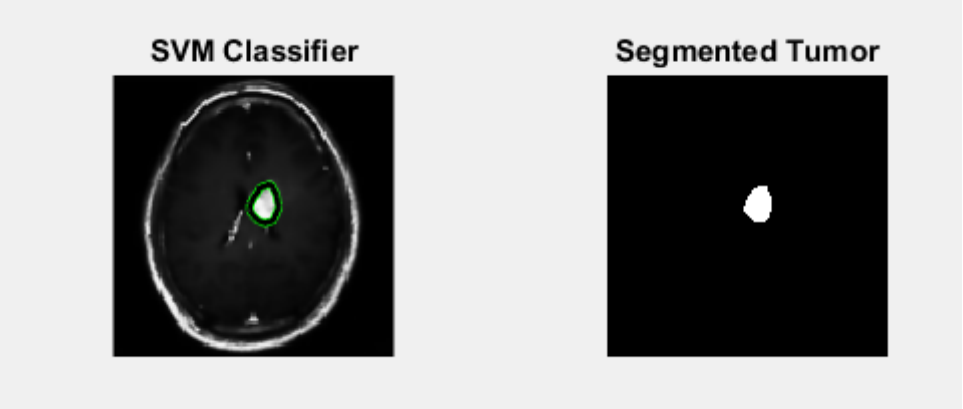

Figure 4

V.CONCLUSION

This paper presents an associated algorithm for a technique that is employed for automatic detection of brain tumor in MRI images. The process in this technique that is carried out are as follows: The first step is taking the input as a MRI image from the dataset. The second step is pre-processing which involves removing the noise and filters the image by using anisotropic diffusion filter method. The third step uses Fast Bounding Box algorithm to locate the tumor by finding out the exact position of the tumor in the brain. After that in last step Support Vector Machine classifier is used to extract tumor from the MRI image.

By applying the proposed technique, the exact location of the tumor in the brain can be located for the treatment purpose. By comparing the result with the existing approach it can be evaluated that the results are more accurate and reliable.
With the detection of location of the tumor from the MRI images the size can also be calculated that can be considered for the future work.

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