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Brain Tumor Detection using Segmentation of MR Images

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Abstract- *Image segmentation is a significant step for image analyst in image processing. Based on preprocessing, segmentation and extracting the features it converts the original image to a compact form, and with the help of this, it is possible to make proper image analysis and understanding the image. If the MRI is given as an input, it can be converted into a gray scale image and using various other algorithms, Brain tumor can be detected.*

Keywords: *Brain Tumor, Benign Malignant, Denoising, Intensity Normalization, Segmentation.*

I. INTRODUCTION

Bio Medical Processing of image is a growing field. There are various types of medical imaging processes available which comprise of many different types of imaging like CT scans, X-Ray and MRI. Magnetic Resonance Image (MRI) is the most reliable and safe. MRI can be preprocessed, and the image can be segmented. This whole process can be done by using Image Processing. The process consists of: PreProcessing, Segmentation, Optimization and Feature Extraction followed by classification, size and volume detection and stage detection. These techniques allow us to identify even the smallest abnormalities in the human brain. The goal of medical imaging is to extract accurate information from these images with the least error possible. Manual Segmentation of human brain tumor is a very tedious job and also time consuming. Hence, Image Processing techniques are applied nowadays in Medical Imaging.

II. REVIEW OF EXISTING APPROACHES

Magnetic resonance imaging (MRI) of the brain is a harmless test that is carried out using a magnetic field and radio waves to produce detailed images of the brain. MRI is used in detecting various conditions of the brain such as swelling, cysts, tumors, bleeding, infections, and inflammatory conditions. The MRI is then analyzed by a radiologist who is trained in interpreting the scans. The radiologist sends a report to doctor, who then discusses the results with you and explain what kind or problem is. The scan includes 9 slices of MRI scans, it takes a lot time to evaluate what type of tumor is and the other characteristics of tumor, so to overcome that problem, direct evaluation of MRI preprocessed images is done in our work. Table 1 shows the rigorous review of different approaches used for detection of brain tumor.

Table 1: Literature Survey of Existing Approaches

Research Paper	Approach	Limitations
Brain Tumor Segmentation Using Convolutional Neural Networks in MRI Images[1]	Novel CNN-based technique for segmentation of brain tumors in MRI.	They should first be trained using Learning process, which sometimes takes very long.
Efficient Detection of Brain Tumor from MRIs Using K-Means Segmentation and Normalized Histogram[2]	MRI is segmented using k-clustering algorithm, SVM and Naïve Bayes Approach	The algorithm could not find out the precise or accurate boundary of the tumor region.
A Survey on Brain Tumor Detection Using Image Processing Techniques[3]	Fuzzy C means Sobel operator for preprocessing Thresholding for Segmentation	Sample selection and establishing fuzzy sets may be tedious
A Two Phase Segmentation Algorithm For MRI Brain Tumor Extraction[4]	Phase I-Histogram Thresholding Phase II-Region Growing phase	Only T1 images are considered. Does not work on other type.
Review Of Brain Tumor Detection Using MRI Images[5]	Combination of modified texture based region growing and cellular automata edge detection is used	Noise may lead to undesired artifacts in final result

Detection of Brain Tumor from MRI images by using Segmentation &SVM[6]	Median filter and by using diagonal, antidiagonal masks segmented images.	High computational cost and less importance to edge preservation
Malignant Brain Tumor Detection [7]	GVF works on the principle of energy minimization and hence it extracts the tumor in an efficient way.	The parameters of GVF have to be controlled manually which takes a lot of time and may also cause errors.
Brain Tumor Detection Using Pattern Recognition Techniques[8]	K-Nearest Neighbour (KNN)	Possibility of yielding an erroneous decision if the obtained single neighbour is an outlier of some other class
Brain Tumour Extraction from MRI Images Using MATLAB[9]	Meyer's flooding Watershed Algorithm	Cannot be used for images with poor contrast or images with a lot of background and foreground artifacts
3D Volume calculation of Brain Tumor Using HOG Feature Extraction And Connected Component [10]	SVM is used as classifier	SVM needs a very long time for traning

III. PROPOSED SYSTEM

The proposed system consists of seven modules as shown in fig. 1: Pre-Processing, Segmentation, Feature Extraction, Classification, Size Detection, Volume Detection, Stage Detection.

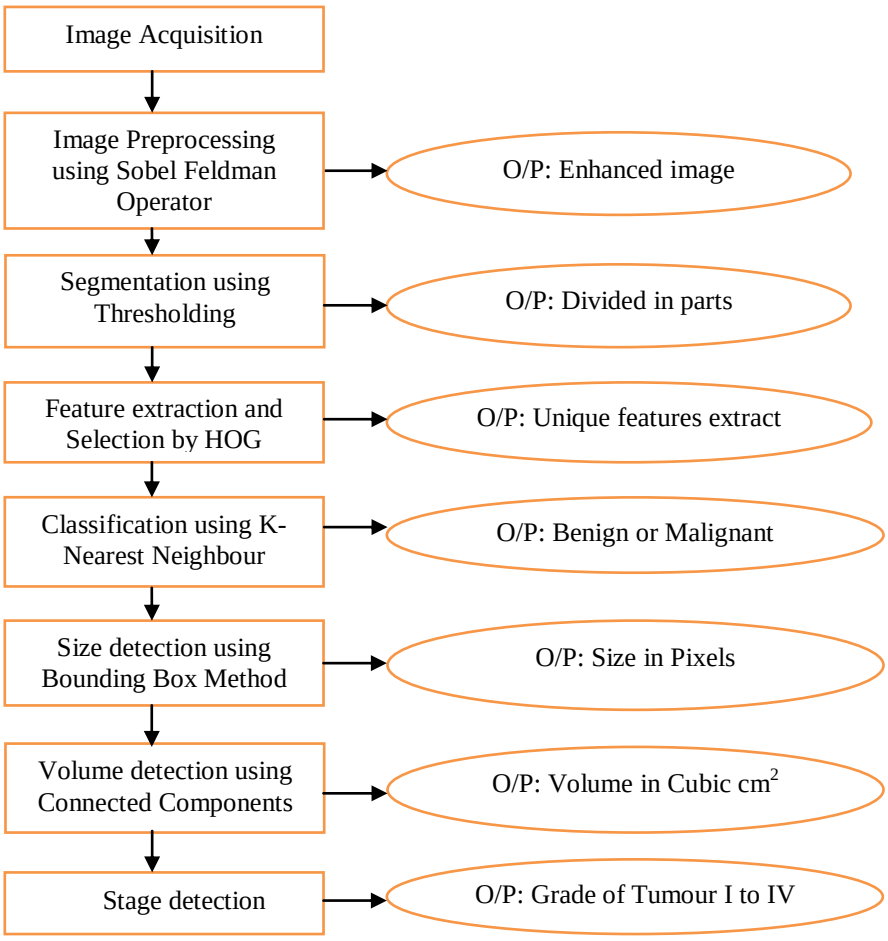

Fig. 1: Architecture of Proposed System

1. **Pre-Processing**: Pre-Processing is carried out by filtering using Sobel-Feldman Operator. It is also known as the Sobel Operator or Sobel filter. This filter is used in processing of image, especially for edge detection techniques, where the focus is on emphasizing the edges.
2. **Segmentation**: The process of segmentation is done by using Thresholding. It is the simplest form of image segmentation. The final output of this stage is binary images.
3. **Feature Extraction**: Feature Extraction is done by Histogram Oriented Gradients (HOG). This is basically like a feature descriptor used for the purpose of object detection.
4. **Classification**: In the next step, Classification is done using K-Nearest Neighbor. The k-NN algorithm is a non parametric method used for the purpose of classification and also regression.
5. **Size Detection**: After this classification, the size and volume of the Tumor is calculated using Bounding Box Method.
6. **Volume Detection**: This can be carried out using two different approaches, the first one being an existing tool known as 3D Slicer. The second approach is Connected Components method. A 3D slicer is an existing open source tool for visualizing objects in three dimensions. Connected Components method assigns a unique label to all the points in a connected component. After finding the region it is created as 3D image and then the volume of the tumor is calculated from the segmented result respectively.
7. **Stage Detection**: Finally, the Stage of the tumor is detected using the size, volume and type of tumor as parameters.

IV. CONCLUSION AND FUTURE WORK

MRI is used by radiologist /doctors to examine the location of tumor in brain but this process is time and energy consuming. As a general conclusion, it can be summarized that the main objective of this work is to develop a technique which not only reduces the efforts of a radiologist, but also assists in detection of tumor. A novel algorithm for the detection of tumor in brain is described in this paper. Our approach successfully managed to depict that the system proposed is a valuable diagnosis technique for the radiologists to detect the brain tumors.

In future, additional information can be included about the features. It will be interesting to continue developing more adaptive methods for other types of brain tumors following the same approach. Another future task would be the detection of other factors which influence the appearance of tumors on images and though there are some features which are common of malignant and benign tumors, there is a great amount of variation that depends on the tissue and tumor type. Efforts can be made to reduce some effects such as architectural distortion.

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