IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 8, Issue 11, November 2019

Development of Improved Classification and Segmentation Technique for Brain Tumor Detection

Ashima Gupta[1], Navneet Agrawal[2]

M. Tech Student, Department of ECE, CTAE, MPUAT, Udaipur, India[1]

Assistant Professor, Department of ECE, CTAE, MPUAT, Udaipur, India[2]

Abstract: The tumor can be detected by segmentation of brain Magnetic Resonance Image (MRI). In the case of suspected brain tumor, the exact location and size of tumor can be determined by radiologist. In this work tumor is detected by various stages like pre-processing, segmentation, feature extraction and classifier. The approach of otsu segmentation is applied for the segmentation. Tumor feature is extracted by Discrete Wavelet Transform (DWT) and Gray Level Co-occurrence Matrix (GLCM). Classification is done by using hidden markov model and performance parameters are measured.

Keywords: HMM, Otsu's segmentation, GLCM

I. INTRODUCTION

Brain tumor is identified as a situation in which the cells existing within the cranium increases abnormally. The brain cancer or tumor initiates from the nerves coming out of the brain, brain cells and the vessels of blood in most of the cases. Tumors can be categorized in two forms and they are malignant (cancerous) and benign (non-cancerous) tumors. Benign tumors are considered as slow increasing tumors [1]. The benign tumors do not extend in the adjoining brain tissue. These tumors will only apply potentially harmful pressure. The malignant tumors are described as fast increasing tumors. These tumors are capable to extend in the surrounding brain. The normal brain cells can be destructed by the tumors because of the generation of inflammation, applying pressure on the brain parts and rising pressure into the head [2]. A number of approaches are used for the scanning of a particular body part like CT scan, X-rays, and Magnetic Resonance Image (MRI) [3]. These pictures are then examined by the surgeons for the removal of the problem. Brain tumor has already become a very big reason of deaths and disabilities globally [4]. Medical Image Processing improves the prior diagnosis of patients who survived with brain cancer. The image processing and image improvement techniques are used for the detection of cerebral cancer. These techniques are used for the improvement of the picture quality for medical image processing. For highlighting the characteristics of the MRI pictures, contrast adjustment and threshold approaches are used. Some techniques are used for the recognition and categorization of brain tumor; some of them are Histogram Method, Edge Recognition, Morphological operations and Segmentation [5]. In order to get precise outcomes, the MRI images must be in accurate format and not contain any unnecessary information. These objectives can be achieved by image preprocessing. Image preprocessing technique involves a number of procedures such as elimination and minimization of unwanted noise, redevelopment of images, up-gradation of the images, and translation to gray scale [6]. It may also include the elimination of cranium from MRI with respect to medical images. Removal of unwanted noise and image enhancement are the two main objectives of image preprocessing. The characteristics of the image are improved with the help of the image preprocessing techniques. A picture is divided into various segments during segmentation process. These regions contain same qualities in terms of texture, color, intensity, contrast and gray level [7]. Thus the main aim of segmentation is the division of the items present in a picture which are connected with other by some means. In feature extraction process, useful information or features of pictures are extracted in the form of statistics, shape, color and texture. Image classification includes a number of things like image preprocessing, object division, characteristic extraction, image detection and much more. Image classification is specified as an extremely imperative and complex job.

II. LITERATURE REVIEW

A Selvapandian, et.al [11] reviewed that the recognition of cancer areas in Glioma brain picture was extremely difficult due to the lesser sensitivity of boundary pixels. In this study, brain image was enhanced through Non-Sub Sampled Contourlet Transform (NSCT) approach. This process provided help in the training and classification of the retrieved features. Morphological functions were then utilized for segmenting the cancer areas existing in the Glioma cranium

picture. For the performance evaluations, the proposed approach was applied on the BRATS dataset and it was seen that the results were improved with respect to certain performance aspects like specificity, sensitivity and accuracy.
Ramesh BabuVallabhaneni, et.al [12] proposed a novel automated brain cancer recognition technique for the pictures which included noise in them. Picture denoising process was applied through Edge Adaptive Total Variation Denoising (EATVD) approach. Within the denoising process, the edges were preserved through this proposed technique. The segmented areas were converted into GLCM matrix for the extraction of features. In this process, contrast, correlation, power and homogeneity characteristics were retrieved. For detecting tumor in images, multi-class SVM was applied by including features. As per the evaluation results it has been seen that the value of precision was increased in the noisy images when the tumor was extracted using these steps. The achieved PSNR (peak signal to noise ratio) values were higher than the conventional methods.

Amin Kabir Anaraki, et.al [13] proposed a new method on the basis of Genetic Algorithm (GA) and Convolutional Neural Network (CNN) for the non-invasive classification of different grades of Glioma through MRI (Magnetic Resonance Imaging) technique. To evolve the architecture of CNN, GA was used in the proposed approach. In the proposed method, GA approach was utilized for the evolution of Convolutional Neural Network (CNN).Bagging in the form of an ensemble algorithm was implemented for the reduction of Variance of Prediction fault on the basis of finest model obtained through GA approach. The assessment of outcomes demonstrated that the cancerous regions were classified from MRI pictures in an effective manner. For the diagnosis of brain tumors in an early stage, this approach could be used commonly by the doctors as they are highly flexible.

Khai Yin Lim, et.al [14] proposed a new technique which involved three significant steps such as data modeling, data fusion and retrieval of visual entity. In this study, genuine brain cancer data suites were employed for evaluating the performance of presented technique. At two separate levels the experimental evaluations were done. In the initial stage of tests, relative scrutiny of presented weighted averaging fusion, conventional averaging and PCA fusion methods was executed. In the secondary level, the brain tumor dataset was included to evaluate the performance of proposed approach which showed that 0.67of average accuracy was achieved. Segmentation, homogeneity and a region-based algorithm named as Object-feature based Random Walks (HORW) were applied for ensuring connectedness in an area. It was identified that proposed technique could be utilized for the determination of region of interest and background.
SolmazAbbasi, et.al [15] proposed a new automated scheme for the detection of brain cancer from three dimensional pictures. In the preliminary stage, Bias field correction and Histogram matching process were used for the pre-processing of pictures. Then region of interest (RoI) was recognized and secluded from the backdrop of clear picture. After preprocessing, Otsu algorithm was implemented for the extraction of region of interest after image pre-processing technique. The performance of presented algorithm was evaluated with the help of Glioma pictures from BRATS 2013 data suite. The region of interest was almost 20 percent of the whole picture which reduced time consumption. The implementation of feature extraction on complete image took 1516 seconds average for every picture.

Muhammad Sajjad, et.al [16] projected a novel CNN-based multi-grade cranium cancer classification approach. A deep learning technique was utilized initially for segmenting the tumor regions from MR image. Further, the proposed system was trained efficiently using the extensive data augmentation in the second step. Though, the concern of information lacking was removed during the dealing with MRI for multi-grade brain cancer classification. Towards the end, the brain tumor grade classification was performed by using augmented data and applying pre-trained VGG-19 CNN model on it. Evaluations were performed on original as well as augmented data and as a result performance metrics such as sensitivity, particularity and accuracy got improved.

III. RESEARCH METHODOLOGY

In this research work, technique will be proposed for the segmentation and classification of brain tumor. The MRI images are given as input and on that images region based segmentation will be applied with the technique of classification to classify cancer and non-cancer regions. The Otsu segmentation will be applied for the region based segmentation and HMM will be applied to classify cancer and non-cancer cells. Algorithms for classification typically go through a sequence of steps, with a set of choices at each step. For many optimization problems, using dynamic programming to determine the best choices is overkill; simpler, more efficient algorithms will do. In order to model the generative sequences those are characterized through an underlying process that creates an observable sequence. It is a powerful statistical tool by which generative sequences are modeled. These sequences further can be characterized by a fundamental process generate an observable sequence. In the various areas application of HMMs can be found in signal processing such as in speech processing.

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 8, Issue 11, November 2019

Different performance analysis parameters of this investigative study are given below:-

i. Specificity: In pattern detection, data extraction and binary classification, Specificity (also called Positive Predictive Value or Precision) is the ratio of related occurrence amongst the extracted occurrences.

$$\text{Specificity} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Positive}}\%$$

ii. Sensitivity: Sensitivity (Recall) is the ratio of related occurrences. These instances or occurrences are extracted over the total sum of related instances.

$$\text{Sensitivity} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Negative}}\%$$

iii. Accuracy*:* Accuracy is defined as the ratio of properly classified number of points to the total number of points multiplied by 100.

$$\text{Accuracy} = \frac{\text{Number of points correctly classified}}{\text{Total Number of points}}\%$$

iv. Efficiency: Efficiency tells the classifier performance as the statistical hypothesis testing.

v.

$$\text{Efficiency} = \frac{\text{Accuracy} + \text{Sensitivity} + \text{Specificity}}{3}$$

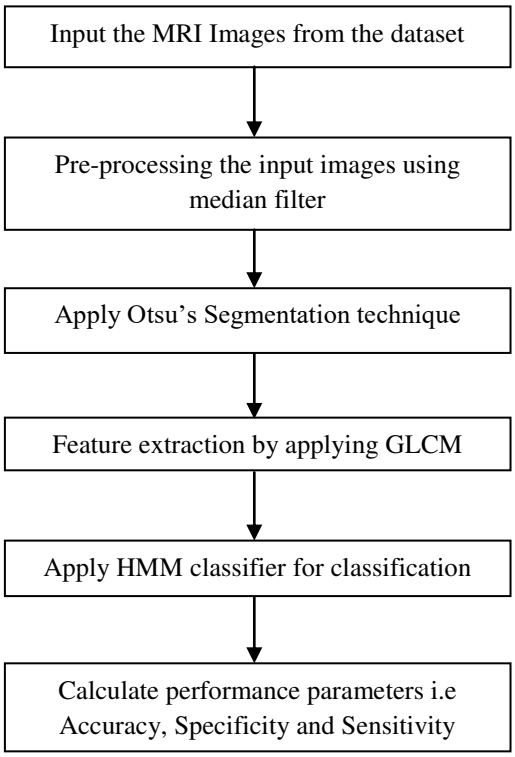

Fig.1 Flow chart of Proposed Methodology

IV. RESULTS AND DISCUSSIONS

The dataset of four different patients have been collected from the hospital. They have diagnosed with specific types of brain tumor. They are having malignant tumor and have not gone under any surgery. The data were acquired from the Midnapore Diagnostics Private Limited at R. G. Kar Medical College and Hospital, Kolkata (West Bengal). Midnapore Diagnostics Pvt. Ltd is a joint venture project with Department of Health and Family Welfare, Govt. of West Bengal. From the entire database 20 MRI images have been searched in which the Brain Tumor is clearly visible.

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 8, Issue 11, November 2019

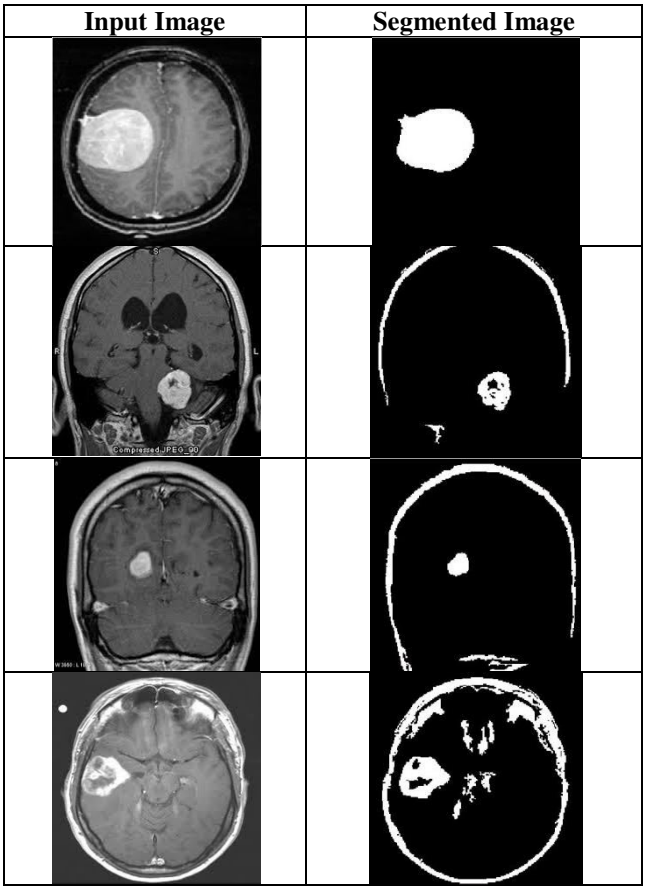

Fig.2. Segmented Images

Fig.2 shows the Segmented Images. The input image after preprocessing is subjected to Otsu Segmentation which is a threshold selection region based segmentation method.

Table 1 Performance Analysis of HMM Classifier

Img no.	Accuracy (%)	Sensitivity (%)	Specificity (%)
1	90	80	80
2	90	80	80
3	90	80	80
4	90	80	60

Table 1 shows the performance analysis of the HMM classifier on the basis of Accuracy, Sensitivity and Specificity. Form the above we can calculate the average efficiency of classifier.

Percentage Efficiency of HMM is found to be:
HMM Classifier = 77.2%

V. CONCLUSION

This paper describes Brain tumor detection using threshold based segmentation technique and classification is performed using HMM classifier. Denoising of MRI image is done with median filter. GLCM algorithm is applied for the textural feature extraction. For the testing and training the data, the machine learning algorithms is applied in the final phase using MATLAB simulator. For detecting the tumor portion, the performances of proposed and existing approaches are compared.
The proposed method can be further extended for brain tumor detection using hybrid classification.

REFERENCES

[1]. Hunnur, S., S., Raut, A., & Kulkarni, S.: "Implementation of image processing for detection of brain tumors", International Conference on Intelligent Computing and Control Systems (ICICCS), July 2017, pp. 717-722
[2]. Manisha, Radhakrishnan, B., & Suresh, L. P. :"Tumor region extraction using edge detection method in brain MRI images", International Conference on Circuit, Power and Computing Technologies (ICCPCT), April 2017, pp. 1-7
[3]. Mathew, A. R., & Anto, P. B. :"Tumor detection and classification of MRI brain image using wavelet transform and SVM. International Conference on Signal Processing and Communication (ICSPC), July 2017, pp.75-78
[4]. Kapoor, L., & Thakur, S. :"A survey on brain tumor detection using image processing techniques". International Conference on Cloud Computing, Data Science & Engineering – Confluence, January 2017, pp.582-585
[5]. Islam, M. R., Imteaz, M. R., & Marium-E-Jannat: "Detection and analysis of brain tumor from MRI by Integrated Thresholding and Morphological Process with Histogram based method", International Conference on Computer, Communication, Chemical, Material and Electronic Engineering (IC4ME2), February 2018, pp. 1-5
[6]. Reddy, D., Dheeraj, Kiran, Bhavana, V., & Krishnappa, H.: "Brain Tumor Detection Using Image Segmentation Techniques", International Conference on Communication and Signal Processing (ICCSP), April 2018, pp.0018-0022
[7]. Archa, S. P., & Kumar, C. S. :"Segmentation of Brain Tumor in MRI Images Using CNN with Edge Detection", International Conference on Emerging Trends and Innovations In Engineering And Technological Research (ICETIETR), July 2018, pp.1-4
[8]. Chew, K. M., Yong, C. Y., Sudirman, R., & Wei, S. T. C. "Bio-signal processing and 2D representation for brain tumor detection using microwave signal analysis", IEEE Symposium on Computer Applications & Industrial Electronics (ISCAIE), April 2018, pp.303-309
[9]. Manju Kadian and Tamanna,:"A Survey on Brain Tumor Detection Technique"2015, IJCSMS (International Journal of Computer Science & Management Studies) 15, (6), pp.1-6
[10]. Ed-Edily Mohd. Azhari, Muhd. Mudzakkir Mohd.Hatta, ZawZaw Htike,:"Detection and Localization In Magnetic Resonance Imaging" International Journal of Information" Brain Tumor Technology Convergence and Services (IJITCS), 2014, 4, (1), pp. 1-7