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Brain Tumor Classification using Various Techniques: A Survey

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ABSTRACT

Brain tumor is a very dangerous and harmful disease. It causes of death. MRI is an essential and faster technique as compared to medical image processing it will provide information of brain tissues through the detailed image of inside of the body, which helps in the diagnosis of brain tumor. Various algorithms and techniques exist for the classification of brain tumor with the help of MRI brain images. in this paper we are going to do comparative study of different techniques of classification of brain tumor using MRI images.

Keywords:— *CNN (convolutional neural network), SVM (support vector machine).*

I. INTRODUCTION

Brain is the most important part in human body which consists a lot of cells. Brain tumor is the growth of unwanted and abnormal cells in the tissues of the brain. It is one of the most harmful cancer which will become the reason of death of an patient so, it is much essential that the detection of tumor for diagnosis of disease. MRI is an automatic and faster technique which provides suitable information of an image and it is helpful for the detection purpose.

There are some techniques through which the classification of brain tumor has been done and in this paper we will show the performance of comparative study of that techniques.

II. RELATED WORKS

Heba Mohsen et al. [2] The performance of proposed system has been done by using DNN architecture through four steps. first step is to get the proper dataset and it consists 66 brain MRI images. the main target of this system is to differentiate tumored and nontumored images. second step is image segmentation in which FCM technique is used to segment the images into 5 sections. in the third step extraction of features with the use of DWT and finally the classification is performed using DNN architecture it gives 96.97% accuracy.

Aswad Sawant et al. [7] proposed an brain cancer detection from MRI images using Machine Learning approach (tensorflow). proposed methodology consists total 1800 brain MRI images including cancerous and noncancerous. in tensorflow they construct CNN using 5 layers. Tensorflow is an software library used in ML as a neural network. here, Adam optimizer is used for stochastic optimization methodology achieved

training accuracy is 99% and validation accuracy is 98.6%.

Himaja Byale, Dr Lingaraju G M and Shekar Shivasubramanian [8] proposed an automatic segmentation and classification of brain tumor ML techniques. this system includes preprocessing, segmentation, feature extraction and classification. main aim of preprocessing step is to remove noise for the better image with the help of adaptive medium filter. region of interest find out using GMM technique. It will help for segmentation purpose. Extraction of features carried out using GLCM. Propose system shows that, is there tumor or not if yes then it is benign or malignant.

93.33% accuracy obtained by proposed methodology.

J. Seetha and S. Selvakumar Raja [5] proposed an classification of brain tumor using CNN. In this system CNN includes 5 layers that are input layer, convolution layer, Rectified linear unit (RELU) layer, pooling and fully connected layer. The CNN based brain tumor classification is divided into two stages training and testing stage. Main aim of the proposed model is to recognize the normal and abnormal images through MRI brain images. SVM is used as a classifier and it gives 97.5% accuracy.

B. Balakumar, P. Raviraj, E. Divya Devi [3] proposed an brain tumor classification using machine learning algorithm in this, three steps are included i.e. preprocessing, feature extraction and classification. denoising and skull stripping is main intension of preprocessing. proposed model contains 60 images including both tumored and non tumored. Adaptive K-means algorithm is used for finding the average mean of the data point. MATLAB has been used for performing this methodology. Histogram of image gives some features and GLCM is used for extracting the features. Using Support vector machine classification has done and it gives 89.5% accuracy.

Ali ARI and Davut Hanbay [6] proposed deep learning based brain tumor classification and detection system, its achievement has been done through three stages pre-processing, classification, tumor region extraction. in this proposed system ELM-LRF technique is used for classification and image processing is used for tumor region extraction. ELM-LRF gives 97.18% accuracy. Code for the model were executed in MATLAB 2015.

Vaishnavi S. Mehekare, Dr. S.R. Ganorkar [4] proposed Brain tumor Detection Using Neural Network. First stage is Pre-processing, which is necessary for getting a noise free image (without changing their content) so that it can easy for next stage i.e. segmentation. here, region growing method is used for segmentation, local binary patterns is one of the method for extracting the features so, it is used here for feature extraction and classification is last stage has been done using CNN.

Hao Dong et al. [13] proposed an automatic brain tumor detection and segmentation using U-Net based fully convolutional networks. it works on the BRATS2015 dataset which include high grade gliomas (HGG) and low grade gliomas (LGG), HGG contains 220 images and LGG contains 54 images. proposed model shows data augmentation with their suitable methods. U-Net based deep convolutional network is used here for segmentation purpose. proposed model is one of the automatic segmentation and detection model and it will give 86

accuracy. There are some limitations of this work, one of them is, they did segmentation using a cross validation scheme, which can provide an unbiased predicter, but if the model can work on separate and independent testing dataset can gives more appraisal. In the future, model can improve and it can recover their limitations.

III. Comparative Study of Brain Tumor Detection and Classification

Comparative study of various techniques used for brain tumor detection and classification shown using tables.

Table 1: Comparison of various Techniques including accuracy

Author with year	Title	Dataset
Heba Mohsen, El-Sayed A. El-Dahshan, El-Sayed M. El- Horbaty, Abdel-Badeeh M. Salem (2017)	Classification using deep Learning neural networks for brain tumors	66 brain MRI images
Aaswad Sawant, Mayur Bhandari, Ravikumar Yadav, Rohan Yele, Mrs. Sneha bendale (2018)	Brain Cancer Detection From MRI: A Machine Learning Approach (Tensorflow)	1800 brain MRI images
Himaja Byale, Dr Linaraju G M and Shekar Shivasubramanian (2018)	Automatic Segmentation and classification of brain tumor using Machine Learning techniques	60 MRI images of brain
J. Seetha and S. Selvakumar (2018)	Brain Tumor Classification Using Convolutional Neural Network	--------
B. Balakumar, P. Raviraj, E.Divya Devi (2017)	Brain Tumor Classification Using ML algorithm	60 MRI images of brain
Ali ARI and Davut Hanbay (2018)	deep learning based brain tumor classification and detection system	16 brain MRI images
Vaishnavi S. Mehekare, Dr.S.R.Ganorkar (2017)	Brain tumor Detection Using Neural Network	100 brain MRI images
Hao Dong, Guang Yang, Fangde Liu,Yuanhan Mo, Yike Guo (2017)	Automatic Brain Tumor Detection and Segmentation Using U-Net Based Fully Convolutional Networks	274 brain MRI images including HGG and LGG

Table 2: Comparison of Various Techniques Including Accuracy

Author with year	Proposed technique	Accuracy in Percentage
Heba Mohsen, El-Sayed A. El-Dahshan, El-Sayed M. El- Horbaty, Abdel-Badeeh M. Salem (2017)	FCM and DNN	96.97%
Aaswad Sawant, Mayur Bhandari, Ravikumar Yadav, Rohan Yele, Mrs. Sneha bendale(2018)	CNN	99%
Himaja Byale, Dr Linaraju G M and Shekar Shivasubramanian(2018)	GMM and MLNN	93.33%
J. Seetha and S.Selvakumar (2018)	CNN and SVM	97.5%
B. Balakumar, P. Raviraj, E.Divya Devi (2017)	SVM	89.5%
Ali ARI and Davut Hanbay(2018)	ELM-LRF	97.18%
Vaishnavi S. Mehekare, Dr. S.R. Ganorkar (2017)	CNN	86%
Hao Dong, Guang Yang, Fangde Liu, Yuanhan Mo, Yike Guo (2017)	U-Net based deep convolutional network	86.00%

Table 3: Comparison with Advantages and Limitations.

Author	Advantages	Limitations
Heba Mohsen, El-Sayed A. El-Dahshan, El-Sayed M. El-Horbaty, Abdel-Badeeh M.Salem(2017)	High accuracy as compared to KNN, LDA, SMO	
Aaswad Sawant, Mayur Bhandari, Ravikumar Yadav, Rohan Yele, mrs. Sneha bendale (2018)	Very high accuracy	
J. Seetha and S. Selvakumar (2018)	In CNN doesn't need to extract features separately	It needs large labeled dataset
B. Balakumar, P. Raviraj, E. Divya Devi (2017)	SVM is effective in high dimensional space	If samples are more than the features then performance will be poor
Ali ARI and Davut Hanbay (2018)	Speed of learning process and less complexity	
Hao Dong, Guang Yang, Fangde Liu, Yuanhan Mo, Yike Guo (2017)	Good performance	Difficult to work on large amount of training dataset

IV. CONCLUSION

In the proposed work, we describe various classification and detection techniques for MRI brain images. performance of these techniques gives better as well as accurate result. mentioned technique have some limitations also, but in future with some improvement in these techniques we can overcome the present limitations.

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