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DEEP LEARNING BASED BRAIN TUMOR DETECTION FROM MRI IMAGE

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Abstract - *Brain tumor is the uttermost disease to cure. It has several grades upon tumor. Totally 205 tumor types are documented. It should cure in the 1st stage of tumor otherwise person's life leads to death. In medical image processing lots of architecture are available to find tumor detection and classification using Convolutional Neural Network (CNN). In this paper, we pro-processed images using mean filter and segment the image using threshold method and DenseNet201 is used for classification with 98%, within a short time and with more accuracy.*

Key Words: Convolutional Neural Network (CNN), Mean Filter, DenseNet201, Accuracy.

1. INTRODUCTION:

Every year 40,000-50000 peoples are diagnosed with tumor these 20 percent are children. The International Association of Cancer Registration (IARC) reported that there are over 28,000 cases of brain tumor reported in India each year more than 24,000 people reportedly die due to brain tumor annually. Brain tumor is a mass of abnormal cells, totally 205 tumours are documented, but two main tumours are primary and metastatic. Secondary brain tumor results from cancer that starts elsewhere in the body spreads to the brain it. It most often occurred in people who have a history of cancer. But in rare cases, a metastatic brain tumor may be the first sign of the cancer. In adult secondary brain tumor are far more common than primary brain tumor.

1.1 Deep Learning

Deep Learning is a subset of machine learning functioning of a neural network inspired by the human brain. These structures are called Neural Networks. Deep Learning is several types of models such as Artificial Neural Networks (ANN), auto encoders, Recurrent Neural Networks (RNN), and reinforcement learning. But there has been one particular model that has grant a lot in the field of computer vision and image analysis which is the convolution neural network or ConvNET.

1.2 Convolutional Neural Network

The term convolution in CNN stands for the mathematical function of convolution which is a special kind of operation wherein two functions are multiplied to produce a third function which expresses how the shape of one function is modified by the others. In this paper used Convolutional Neural Network (CNN) architecture Dense Net 256, ResNet 101 to detect and classify (benign, Malignant, Pituitary) brain tumor

2. Methodology

2.1 Related Work

Deep learning architectures convolution neural network explain in (1), and describe the accuracy by SoftMax and classification layers. That is common or all pre-trained neural network. Radial Basis Function (RBF) and Decision Tree (DT) classifier are used or the classification (1) with 95% accuracy. Machine Learning Technique from neural network is used for the classification with 91%. Support Vector Machine (SVM) is basically used for the classification and with K-nearest neighbor is used in (3) with 95.1%. Alex pre-trained is used in (10) with 97.5%. Retinal fundus images were used in (9) and to classify with deep learning layers.

2.2 Image Acquisition

In our research paper, we implement a CNN based classifier, gathered from kaggle. It consists of T,1T2, FLAIR sequence images. A division of image consists of three types of tumor Benign, Malignant, Pituitary and no Tumor. According to classification we have to separate as a division for testing and training 70% for training and 30% for testing.

2.3 Work Flow

The Workflow of proposed paper, Image as input and preprocessed using filters for removing noise using mean filter and segment the filtered image using threshold segmentation technique and classification was done by Dense Net 256.

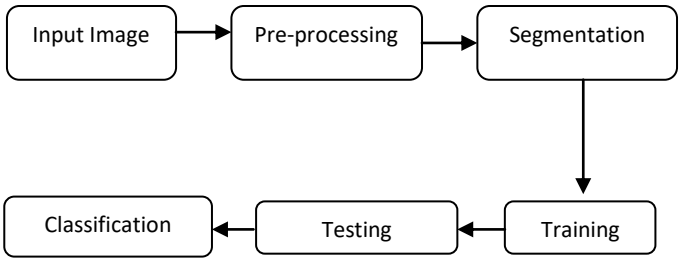


Fig: 1 Work Flow

2.4 PRE-PROCESSING

To remove unwanted noise and to improve the brightness of the image we have to filter the image using filters in the preprocessing at first stage. It improves the quality of the image without the loss of any information in the image. In this, paper we have proposed mean filter for filtering the image, and move to further process like Segmentation, Feature Extraction and Classification.

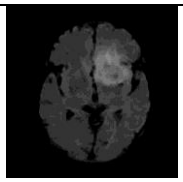
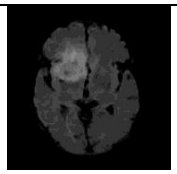
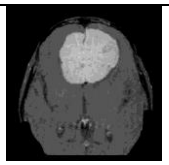
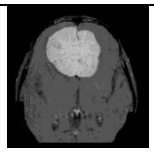
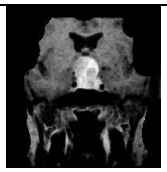
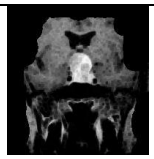
TUMOUR TYPES	INPUT IMAGE	OUTPUT IMAGE
GLIOMA		
MENINGIOMA		
PITUITARY		

Fig-2: Filtered Image

2.4 SEGMENTATION:

Segmentation subdivides an image into constituent regions or objects. The level to which the subdivision is carried depends on the problems being solved (i.e.) Segmentation stops when the objects of the interest have been isolated. Segmentation accuracy determines the eventual success of computerized analysis procedures. For this reason more care should be taken to improve the probability of rugged segmentation. In this paper, Threshold Segmentation Technique is proposed. The name Threshold is nothing but the image intensity is set by manually. It converts the pixel below the set threshold values to black and above to white.

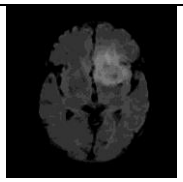
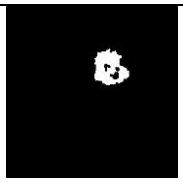
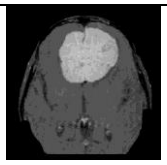
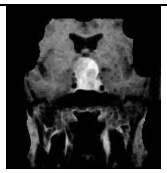
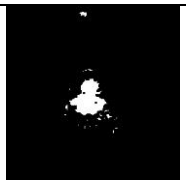
TUMOUR TYPES	INPUT IMAGE	OUTPUT IMAGE
GLIOMA		
MENINGIOMA		
PITUITARY		

Fig -3: Segmented image

2.5 CLASSIFICATION:

In this paper, our contribution is to classify the types of tumors using Convolution Neural Architecture (CNN). More number of architectures was introduced like VGG, ResNet, AlexNet, Sequence Net, etc. In this paper we use DenseNet201, it had more720 layers in neural network classification accuracy will high by increasing the layers. Hence, we use DenseNet201.

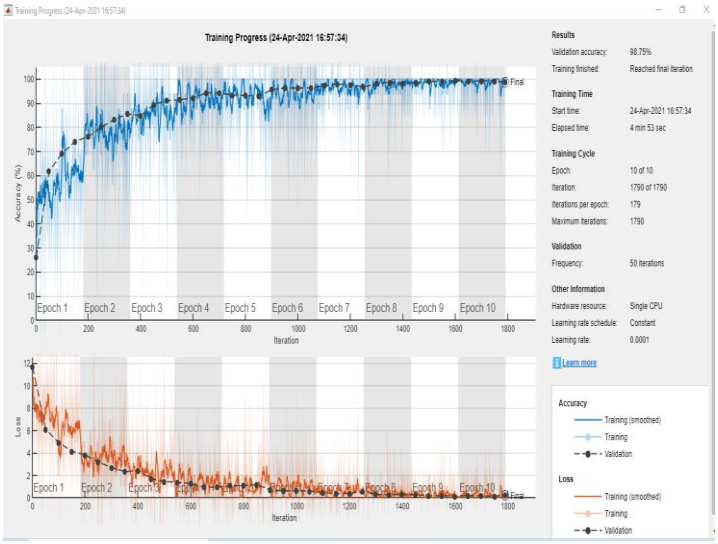


Fig-4: Training process of Train Image Dataset

Accuracy is one metric for evaluating classification models. It is the fraction of predictions our model got right. Formally, accuracy has the following definition,

Accuracy=Number of correct predictions /Total number of predictions.

Hence the accuracy of classification is 97% with elapsed time 4 minutes 35 seconds.

Classification accuracy alone can be misleading if an unequal number of observations in each class or if more than two class in dataset. Calculating a confusion matrix can give a better idea of what classification model is getting right and what types of errors it is making. Here the total accuracy is 99% but some of the types of tumor got a little bit of errors, that shown values in percentage.

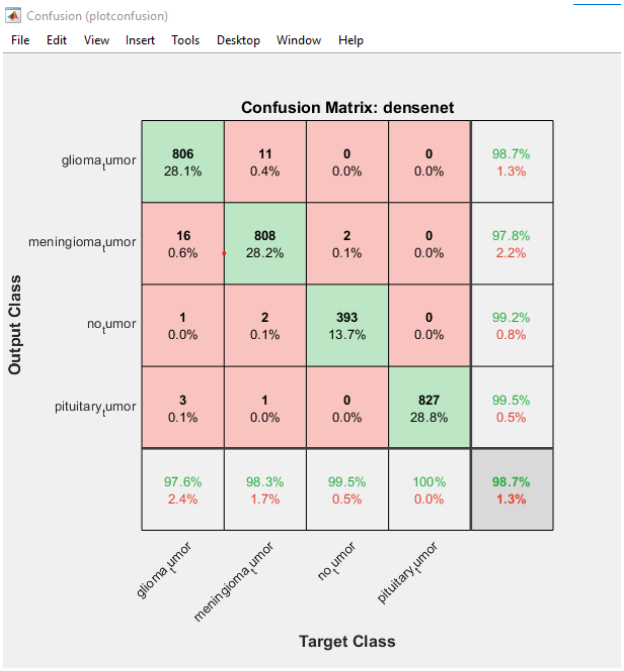


Fig-5: Confusion Matrix

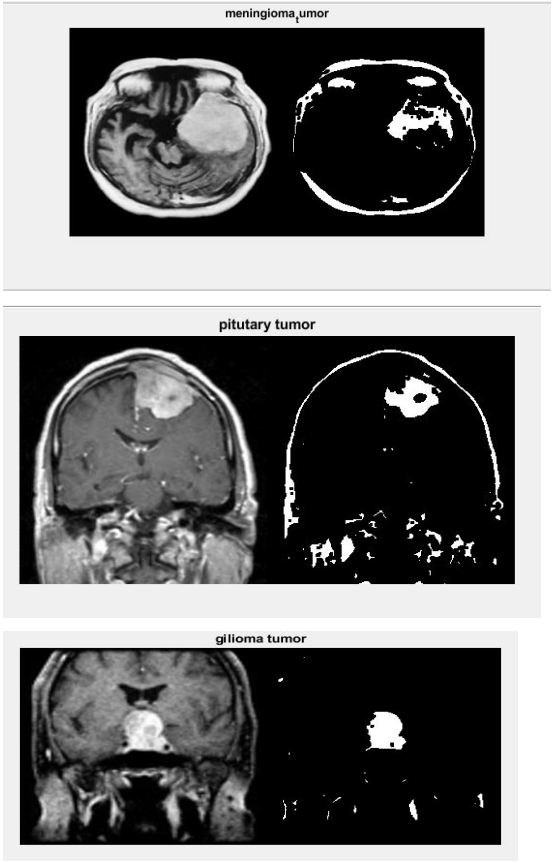


Fig- 6: Classification of Tumor

False positive vs Detection Rate determine the detection of tumor and it represent by Detection Rate and error is represnet by False Positive Rate. It concludes the accuracy of tumor in graphical representation.

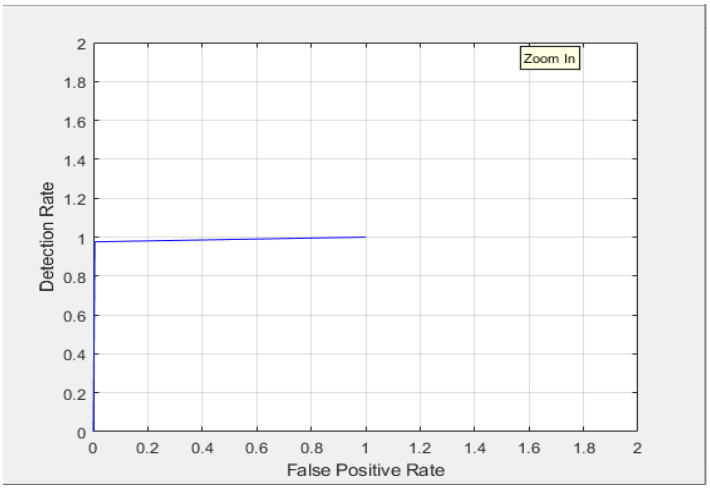


Fig-6: Graphical Representation

3. CONCLUSIONS

In this, project using MRI image of the brain used pre-processing to improve the signal to noise ratio and to eliminate the effect of unwanted noise. By comparing the mean square error and peak signal to noise ratio, chosen the mean filter processing. Furthermore, used threshold method to segment the image and Dens Net 201 architecture to classify the tumor stage. The experimental result achieved 98.7% accuracy demonstrates the effectiveness of the proposed technique for identifying the effectiveness of the proposed technique for identifying normal and abnormal tissues and classify the tumor from MRI image.

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