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CLASSIFICATION OF BRAIN TUMORS IN MRI IMAGES

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***Abstract*:** This paper aims to detect presence of brain tumor given a MRI image. The problem of detecting the brain tumor is considered as classification problem and has been solved using one of the latest technique convolutional neural network (CNN). CNN is the latest approach used for solving many challenging applications in the field f image processing, signal processing.

Keywords: CNN, Classification, Preprocessing, Feature Extraction

I. INTRODUCTION

Brain tumor is a disease that can lead to disability and in severe condition can be fatal. If not detected and treated at an early stage, the patient might die [1, 2]. To diagnose brain tumor, MRI, CT, PET scan is done and the images obtained from these scanners is analyzed by radiologists and presence or absence of tumor is as per their analysis. Here we propose to use deep learning module called CNN [1] for classifying a given MRI image for presence or absence of tumor.

Deep Learning modules refers to the class of computing machines that can learn a hierarchy of features by building high level features from low level ones. There by automating process of feature extraction for classification.

CNN comprises several layers of processing involving learnable operators and hence has the ability to learn a hierarchy of information by building high level from low level.

A. Preprocessing

Removing the unwanted noise from the image, data augmentation [3], normalization.

B. Extraction

The feature extraction [5] is done using deep learning, instead of traditional methods of SIFT, HOG.

C. Classification

After the features are extracted and selected the classification [6] step using deep learning is performed on the resulted feature vector.

II. METHODOLOGY

A. Data pre-processing

In total, datasets from 215 subjects are collected and studied in this investigation, including 29 without tumor images (refer fig 1) and 187 with tumor images (refer fig 2). The images are augmented to increase the data size by rotation and shearing. The images are also normalized.

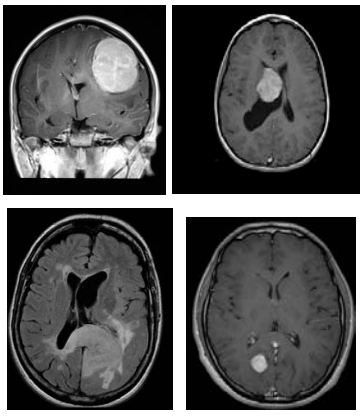

Figure 1. With tumor brain image

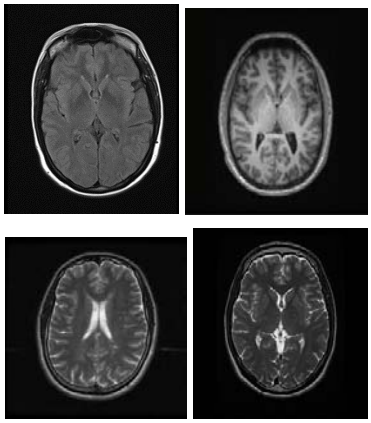

Figure 2. Without tumor brain image

In this process the feature extraction s through CNN. The preprocesses augmented image is fed into CNN architecture made of 2 layers of Convolution, 2 layers of maxpooling with ReLU the activation function and adam as the optimizer. The 64*64 image is first fed into 32 convolutional filters of size 3*3, the output of the convolutional layer is fed into ReLU and then sent to a maxpooling layer for reducing the output size. The reduced output is fed into 32 convolutional filters of size 3*3 and the resultant output to ReLU and further to maxpool layer. The CNN architecture used is shown in fig 3

C. Classification

The features extracted are fed into 2 layers of fully connected neural network with activation function ReLU at the first layer and Sigmoid at the second layer.

B. Extraction

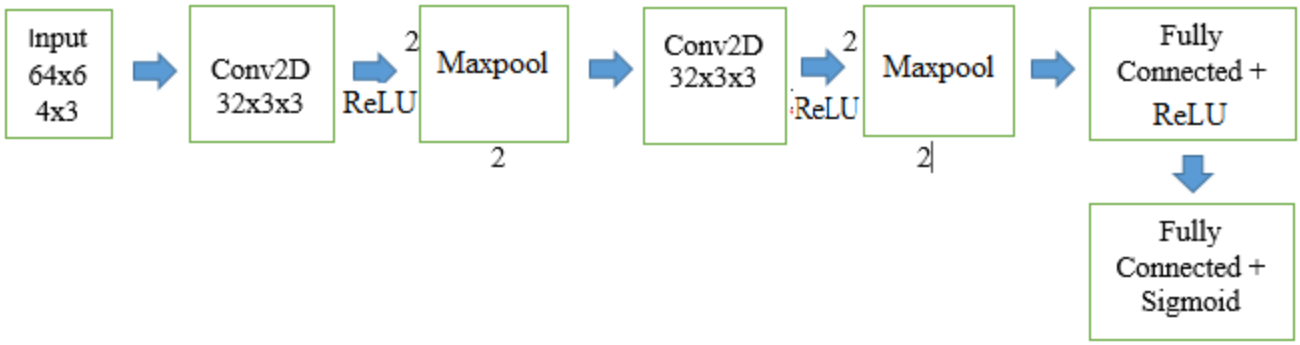

Figure 3. Architecture of proposed CNN Framework

III. IMPLEMENTATION

The code was written using python and used keras and tensorflow. The datset was taken from kaggle website. The training set consisted of 217 images with 187 images containing tumor and remaining without tumor. The CNN was trained for 10,000 epochs. And then tested using 3 fold cross validation and tested for accuracy. We obtained an accuracy of 92%.

IV. CONCLUSION

In this paper, we developed the CNN classifier, to identify the presence of brain tumor given a MRI image of the brain. The results denote good accuracy for prediction of the brain tumor.

V. FUTURE WORK

As a future enhancement we can identify the different types of brain tumors present in the human brain. There are two types of brain tumor's namely Malignant and Benign, in future we can easily identity the exact location and dimensions of the brain tumor. In severe conditions brain tumor leads to death, by using deep learning we can predict the life span of tumor. Generalize the solution further to carry out relevant clinical tasks such as predicting the overall survival of patents and predicting whether the tumor is shrinking, expanding or remain stable. Deeper CNN architectures are generally more promising in increasing the accuracy of segmentation output. Upon the presence of large MRI tumor datasets, it's highly recommended to try deeper CNN architectures.

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