Brain Tumor Detection

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Abstract— A *tumor is a lump that grows abnormally without any control. It can be dangerous in most cases. At an early stage, a brain tumor can be a strenuous task even for doctors to figure out. Using MRI Images is not always reliable, as they contain noise and other disturbances, so hence it becomes difficult for doctors to identify tumor and their causes. So, this is where Image Processing comes, few of it's techniques are used to recognize the image of interest in order to visualize the images easily. We propose a system which detects tumor from brain MRI images. First, we do processing of the image by converting the given image into a grey scale image and some filters are applied to filter noise and other disturbances from the image and find out contours of the image,then we construct the CNN layers and perform classification using CNN(Convolution neural network).This suggested work accomplishes brain tumor prediction and detection using keras and tensorflow, in which anaconda framework is used.*

Keywords: Brain tumor detection system, Brain Tumor, Accuracy, prediction, Anaconda Framework, TensorFlow, Keras.

I. INTRODUCTION

A tumor is a lump that grows abnormally without any control. Many tests are performed by doctors to spot the brain tumor and understand the different types of brain tumor and also to see whether if it has escalated to other parts of the body, which is called metastasis and it doesn't always happen to a tumor present. They may also perform various tests to understand different kinds of medical attention, which would be suited best. Give below are some of the methods , doctors follows: MRI ,CT Scan, surgical removal of a tumor etc. All if the above methods take a huge amount of time and may not always give accurate results and the concerned doctor may consider these elements when opting a medical test, the tumor type which is suspected, signs, age, gender, symptoms and the results of previous medical history, general health of the person affected .We proposed a system which detects tumor from brain MRI images. First, we do processing of the image by converting the given image into a grey scale image and some filters are applied to filter noise and other disturbances from the image and find out contours of the image, then we construct the CNN layers and perform binary class classification using CNN(Convolution neural network).This suggested work accomplishes Brain Tumor segmentation using Keras and Tensorflow, in which anaconda framework is used.

Image processing in Bio medical field is quite similar to biomedical signal processing. It involves enhancing of images captured through an X-ray and performing analysis over it. Image processing is used to process the images by using an algorithm. Pre-processing is required in image process to perform some operations on an image like filtering, colour transforms etc. This is done, so that the image does have any impurities.

In olden days, to construct one image, by a CT scanner it took at least 24hrs, but now with help of MRI image and open CV library, this is reduced to seconds. This library has 2500+algorithms (which are optimized) which include computer vision and machine learning algorithms. Open CV supports C, Python, C++, Java and support Android, Linux, MACOS and Windows. The software required for the implementation of this project are: Open CV, Numpy, keras, TensorFlow, Anaconda. This work uses CNN algorithm**.** Here the MRI images are trained, processed, analyzed and classified by using Convolution Neural Networks algorithm. CNN is an

algorithm that is used for the identification of 2D image and to get information from it. It has more layers:

1. input layer
2. convolution layer
3. pooling layer
4. fully connected layer (also called as dense layer)

CNN doesn't require much pre-processing compared to other image classification algorithms. The image classifier performs binary class classification.There are many domains available for brain tumor detection like in machine learning, deep learning etc. we followed a deep learning approach ,with image processing domain.This system is implemented in anaconda framework in jupyter notebook.

II. RELATED WORKS

The proposed work in paper [1] uses a machine learning approach to detect the brain tumor from brain. The paper was proposed by Aaswad Sawant, Mayur Bhandari, Ravikumar Yadav, RohanYele and Mrs.SnehaBendale. According to it, to detect dangerous cells in brain will be efficient, if this approach and classification of image will be used. Using tensorflow , they have implemented five CNN layers. The procedure they followed, was first performing dataset acquisition, data augmentation and model creation. The advantages of this system are that the training and validation accuracy was found to be 99% and 98.6% and an alternative way used by surgeons, radiologists etc, to detect brain tumor easily can be done using this system. This system is more efficient and accurate. This system is still under

development.

The proposed work in paper [2]is used to detect accuracy of brain tumor and it was proposed by Sadaf Naz and Nitesh Kumar. According to this paper it is designed to detect accuracy of the brain tumor based on the input image given and it mainly composes of the phases like taking an image as an input, preprocessing of the image and edge detection and after which finding region of interest and doing basic morphological operations onthe input and finally classifying using deep learning techniques. It increases the probability of detection as well as exaction of tumor under certain constraints and plays an important role in detecting tumor at the first stages itself and has an accuracy of 93.7%.It has problems in pattern recognition in the phase of segmentation.The proposed work in paper [3] is used to used to predict brain cancer and the result will be classification based on the MRI images produced as an input to the system, to detect the image depicts brain cancer and provide prevention and care that should be taken for brain cancer .The whole process of detecting brain tumor from an MRI image provided as an input can be classified into four different categories: Dataset training, Pre-processing, Analyzing, Classification using CNN Algorithm and using OpenCV. The main advantages of using this approach is that Classification is done to classify the brain MRI images. Prevention can be taken to save the person at an early stage. Size and stage of tumor is described. This project cannot work on algorithms for color images. It cannot identify the type of brain cancer.

The proposed work in paper [4] is used to classify the size of the tumor from the input MRI image which is given as an input to the algorithm and it is proposed by Vrishali A.Wanaj and others. According to this paper the process starts by taking an MRI image, and conversion of that image isdone by applying weighed method and the values of RGB are applied as so the blue is having

value in between red and green values and red ishaving the least value of the other two and green is having the highest value by doing so we can get the exact image i.e, grey scale image or else another method is considered where we take an average of the three colors that is red, green and blue then we get a black image as an output of this particular step of an algorithm which is not required for us as an output. Apply Noise removal filters to remove Gaussian noise from the image present and Sharp the edges of the images by using Sharpening filters Apply Morphological operations i.e, dilate and Erode after the noise removal through Gaussian Noise for Further removal of Noise as part of the requirement of getting a noise free image for better classification of the tumor size and after applying the Morphological operations on the image given after removal of noise detection of contours is done by calling an inbuilt function in OpenCV and as a final note classification is done using CNN algorithm.

III. METHODOLOGY

We propose a system which detects tumor from brain MRI images. The MRI images are processed, trained and classified. First, we do processing of the image by converting the given image into a grey scale image and some filters are applied to filter noise and other disturbances from the image and find out contours of the image, and we afterwards crop the image. Here just one image is chosen and shown. Afterwards ,we perform augmentation of the image dataset, so that the images can increase and can be used in training of the CNN layers. Then images are split into training, testing and validation datasets. The images, which are trained will be of 70% of the total dataset and the validation and testing will take up 15% each of the total dataset. Then we construct the CNN layers and perform classification. This is a binary class classification as the output is 0 or 1 , which means normal or tumor. This project is implemented in Jupyter notebook.

Convolution Neural Network is an algorithm that is used in our project,for the identification of 2D image and to get information from it. It has mainly has the following layers: input layer, zero padding layer,convolution layer, max pooling layer, and fully connected layer. CNN doesn't require much pre-processing compared to other image classification algorithms. The

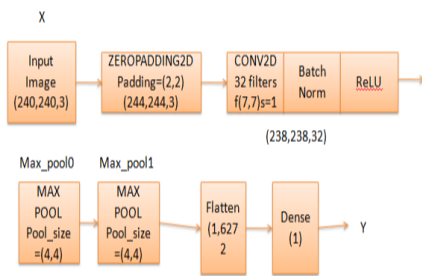below figure is the methodology of our project.

Figure 1 Methodology

The entire dataset contains 255 Mri images ,with two folders yes and no ,in which yes folder contains all bain images with tumors and No folder contains all images which has no tumor.the Yes folder has 155 images and the No folder has 98 images of brain.Comming to the project, we have imported required modules like imults, sklearn, Tensorflow ,numpy, matplotlib, os, opencv, keras, time etc. Afterwards, we have taken an example image for pre- processing,cropping for that we read an image from the dataset and afterwards converted into an greyscaled image and blured it using guassian filter.then applied set of basic morphological operations called erode and dilate using thresholding.by using cv2.findContours() function and then grabing the largest contour by using imults.grab_contours() and max() functions respectively.To perform cropping on the image, we first found the four extreme points on the image ,then ,we cropped a new image using the

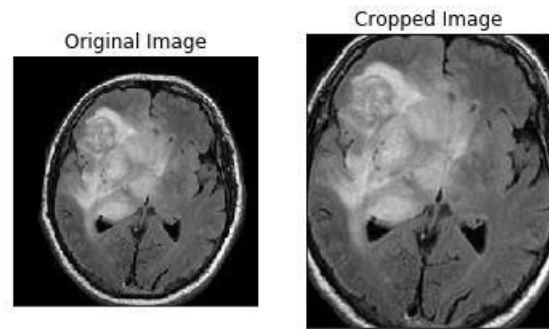four extreme points. After cropping the image will look like this:

Figure 2 Cropped Image

To load the dataset into the jupyter notebook ,we provided the directory list and image size as an input to the function and in that function, we read each image and for each of these images ,we have done the following: Cropped the required image part, resized the image as the dataset consists of images in different sizes,this standardizes all the images into same size.we kept standard size as (240,240,3), meaning width and height of all the images are 240 and channel number of the images is 3.Normaliation is applied ,so that all the pixel values will range from 0-1.then we convert the images of yes and no folders into an array and we append it to label X and Y respectively , next we shuffle all the images so as to change the order.Then, we return X and Y.

Augmentation of data is performed as Convolution NeuralNetwork requires large datasets to work on. Augumented data(Yes and No) consists of both the original and new generated images.After Augumenting,

the total number of images are 2065.Ploting of the first 40 images is as shown below:
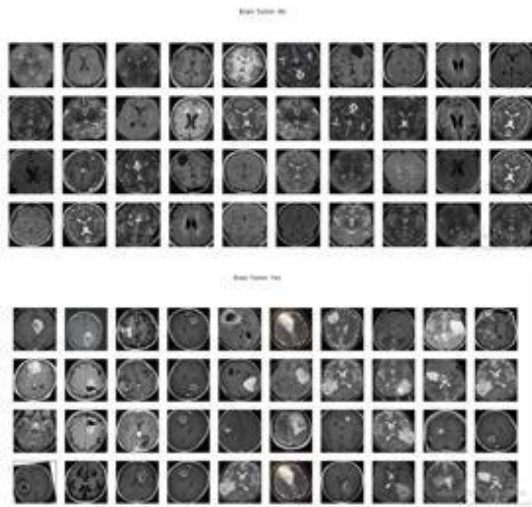

Figure 3 Augmented Image

The data is divided into test ,train and validation or development datasets respectively.

The MRI image which is pre-processed is given to the input layer of Convolution neural network as an input and it is first padded in the zero padding layer and then, it goes into convolutional layer, where convolution operation is performed.to do this operation, we provide some filters, and the input image, where batch normalization and ReLU activation function is appliedfor each convolution operation. Afterwards, it is given as an input to the pooling layer, which further down samples the image for fast computation. The last layer is the dense layer, as it takes the information from all other foregoing layers and classifies the image.

To minimize the parameters (weights) of the neural network we used Binary Crossentropy as the loss function ,as our project requires to classify the images into into classes(normal or tumor).we also used Relu and sigmoid activation functions in our project. This project uses ADAM optimizer (Adaptive Moment Estimation) . It's main advantage is accuracy. The metrics and optimizer and loss are given to the model using model.compile() function.CNN is used here because it's not too complex for this dataset and also by considering the computing capability and memory requirements. we also found the prediction values of each image and also their loss and accuracy and f1 score.The loss and accuracy graphs are as follows:
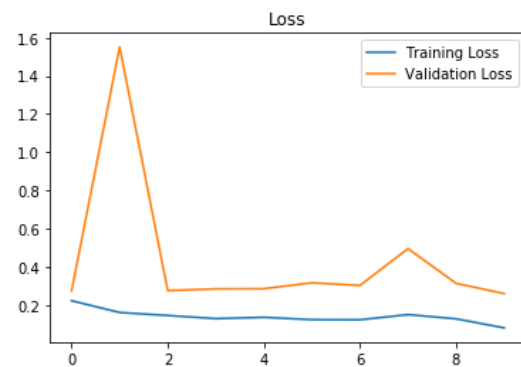

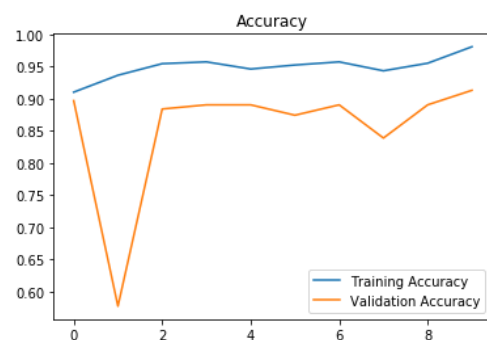*Figure 4 loss of test and validation data*

Figure 5 accuracy of test and validation data

In the dense layer,the trained images will be classified.This means the images which are taken as input ,will be converted to output in the form of either target classes or probability of the images belonging to peculiar class.The output of an images chosen are as follow:
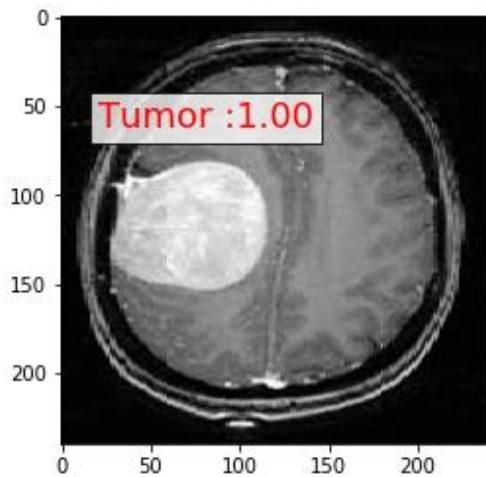
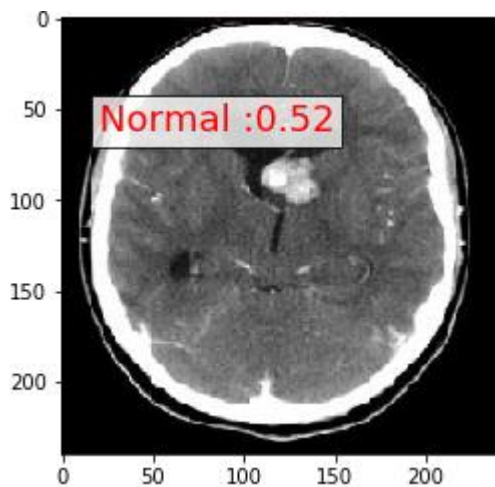*Figure 6 classification of image into tumor class and it's probability*

Figure 7 classification of image into non-tumor(Normal) class and it's probability

This project is done in an jupyter notebook and is afterwards converted into an application using cloud technology(by connecting the kernel to cloud).

IV. CONCLUSION

The main objective behind this project is to review an idea of detection of brain tumor from the image which is taken as an input and can classify whether the given is having a tumor or not using Convolutional neural network. And the layers are constructed by using Tensorflow and which is mainly used because of its ease of construction of layers of CNN.

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