JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

BRAIN TUMOR DETECTION USING FASTER REGION-BASED CONVOLUTIONAL NEURAL NETWORKS

DR. D LIKHITH REDDY[1], M. SNEHITHA[2], K. NITISH KUMAR[3], SD. ABEED[4], G. APARNA[5], G. MOUNIKA[6]

[2,3,4,5,6]UG -STUDENT, [1]ASSISTANT PROFESSOR

DEPT OF ELECTRONICS AND COMMUNICATION ENGINEERING,
PBR VISVODAYA INSTITUTE TECHOLOGY AND SCIENCE,
KAVALI, NELLORE (DIST), ANDHAR PRADESH, INDIA.

ABSTRACT

Automated defect detection in medical imaging has become the emergent field in several medical diagnostic applications. Automated detection of tumor in MRI is very crucial as it provides information about abnormal tissues which is necessary for planning treatment. The conventional method for defect detection in magnetic resonance brain images is human inspection. This method is impractical due to large amount of data. Hence, trusted and automatic classification schemes are essential to prevent the death rate of human. So, automated tumor detection methods are developed as it would save radiologist time and obtain a tested accuracy. The MRI brain tumor detection is complicated task due to complexity and variance of tumors. Inthis project, we propose the machine learning algorithms to overcome the drawbacks of traditional classifiers where tumor is detected in brain MRI using machine learning algorithms. Machine learning and image classifier can be used to efficiently detect cancer cells in brain through MRI. Convolution Neural Network (CNN) segmentation techniques for reliabledetection of the tumor region. Training, testing, and validation datasets are used. Based onour machine, we will predict whether the subject has a brain tumor or not. The resultant outcomes will be examined through various performance examined metrics that include accuracy, sensitivity, and specificity. It is desired that the proposed work would exhibit a more exceptional performance over its counterparts.

Keywords: Brain tumor, MRI scan, Convolution Neural Network & Streamlit Framework.

1. INTRODUCTION

Medical imaging is the technique and process of creating visual representationsof the interior of a body for clinical analysis and medical intervention, as well as visualrepresentation of the function of some organs or tissues. Medical imaging seeks to reveal internal structures hidden by the skin and bones, as well as to diagnose and treat disease. Medical imaging also establishes a database of normal anatomy and physiology to make it possible to identify abnormalities. The medical imaging processing refers to handling images by using the computer. This processing includes many types of techniques and operations such as image gaining, storage, presentation, and communication. This process pursues the disorder identification and management. This process creates a data bank of the regular structure and function of the organs to make it easy to recognize the anomalies. This process includes both organic and radiological imaging which used electromagnetic energies (X-rays and gamma), sonography, magnetic, scopes, and thermal and isotope imaging. There are many other technologies used to record information about the location and function of the body.

An image processing technique is the usage of a computer to manipulate the digital image. This technique has many benefits such as elasticity, adaptability, data storing, and communication. With the growth of different image resizing techniques, the images can be kept efficiently. This technique has many sets of rules to perform in the images synchronously. The 2D and 3D images can be processed in multiple dimensions.

2. LITERATURE REVIEW

A NEURAL NETWORK-BASED METHOD FOR BRAIN ABNORMALITY DETECTION IN MRIMAGES USING GABOR WAVELETS

Nowadays, automatic defects detection in MR images is very important in many diagnostic and therapeutic applications. This paper introduces a Novel automatic braintumor detection method that uses T1, T2_weighted and PD, MR images to determine any abnormality in brain tissues. Here, it has been tried to give a clear description frombrain tissues using Gabor wavelets, energy, entropy, contrast and some other statistic features such as mean, median, variance, correlation, values of maximum and minimumintensity. It is used from a feature selection method to reduce the feature space too. thismethod uses from neural network to do this classification. The purpose of this project is to classify the brain tissues to normal and abnormal classes automatically, which saves the radiologist time, increases accuracy and yield of diagnosis.

SURVEY ON BRAIN TUMOR DETECTION TECHNIQUES USING MAGNETIC RESONANCE IMAGE

The brain tumor is an abnormal growth of cells inside the skull which causes damage to the other cells necessary for functioning human brain. Brain tumor detection is a challenging task due to the complex structure of the human brain. MRI images generated from MRI scanners using strong magnetic fields and radio waves to form images of the body which helps for medical diagnosis. This paper gives an overview ofthe various techniques used to detect the tumor in the human brain using MRI images.

A REVIEW ON VGG-16 IMAGE SEGMENTATION ALGORITHM

Image segmentation is the fundamental approach of digital image processing. Among all thesegmentation methods, VGG-16 method is one of the most successful methods for image Classification because of its simple calculation. VGG-16 is containing different layers to get better accuracy.

NEURAL NETWORKS FOR IMAGES CLASSIFICATION

Neural network can be used to recognize or detect object category but it will require more works to uniquely identify an object. A classical neural network requires to input a set of features extracted from each of the image. Deep neural network (DNN) works with image pixels. An image can be represented as a matrix, each element of the matrix containing color information for a pixel. The matrix is used as input data into the neural network. The small dimensions of the images, to easily and quickly help learning, establish the size of the vec-tor and the number of input vectors. The transfer function used is also called an activation function. Processing of images with artificial neural network.

TYPES OF NEURAL NETWORKS

- **Feedforward Neural Network**

This neural network is one of the simplest forms of ANN, where the data or the input travels in one direction. The data passes throughthe input nodes and exit on the output nodes.

- **Radial Basis Function Neural Network**

Radial basis functions consider the distance of a point with respect to the center. RBF functions have two layers, first where the features are combined with the Radial Basis Function.

EXISTING SYSTEM

Deep Learning is a subset of machine learning algorithms that is very good at recognizing patterns but typically requires a large amount of data. Deep learning excels in recognizing objects in images as it is implemented using three or more layers of artificial neural networks layer is responsible for extracting one or more features of the image.

Deep Neural Network (DNN) is incorporated for brain tumor classification with less accuracy. This technique is compared with Linear Discriminant Analysis (LDA) and Sequential Minimal Optimization (SMO) classification methods. An accuracy rate of 68.19% in the analysis of DNN based brain tumor classification but the complexity is very high and performance is very poor.

3. PROPOSED SYSTEM

3.1 CONVOLUTION NEURAL NETWORK

The human brain is modeled by using design and implementation of Convolution neural network. The Convolution neural network is mainly used for vector quantization, approximation, data clustering, pattern matching, optimization functions and classification techniques.

The block diagram (Fig:1) of brain tumor classification based on convolution neural network is shown in next slide. The CNN based brain tumor classification is divided into two phases such as training and testing phases. The number of images is divided into different category by using labels name such as tumor and non-tumor brain image…etc. In the training phase, preprocessing, feature extraction and classification with Loss function is performed to make a prediction model. Initially, label the training image set. In the preprocessing image resizing is applied to change size of the image.

3.2 METHODOLOGY

The part of the image containing the tumor normally has more intensity than the other portion and we can assume the area, shape and radius of the tumor in the image. We have used these basic conditions to detect tumor in our code and the code goes through the following steps.

4. BLOCK DIAGRAM

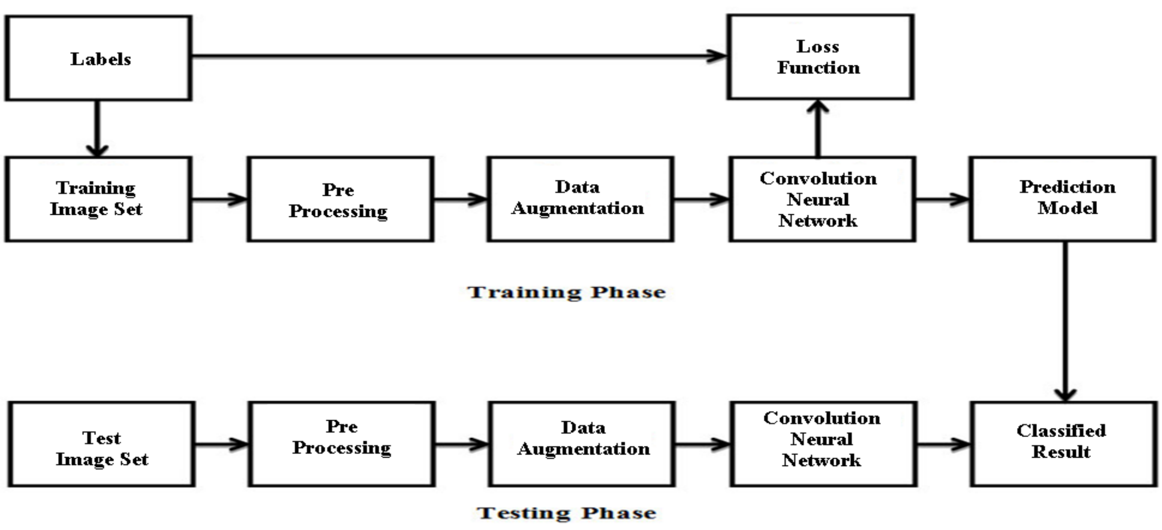


Figure: 1 Block Diagram of Brain Tumor Classification using CNN

5. IMAGE PROCESSING

The Brain MRI image dataset has been downloaded from the Kaggle. The MRIdataset consists of around 1900 MRI images, including normal, benign, and malignant.These MRI images are taken as input to the primary step. The pre-processing is an essential and initial step in improving the quality of the brain MRI Image. The critical steps in pre-processing are the reduction of impulsive noises and image resizing. In theinitial phase, we convert the brain MRI image into its corresponding gray-scale image.The removal of unwanted noise is done using the adaptive bilateral filtering technique to remove the distorted noises that are present in the brain picture. This improves the diagnosis and also increase the classification accuracy rate.

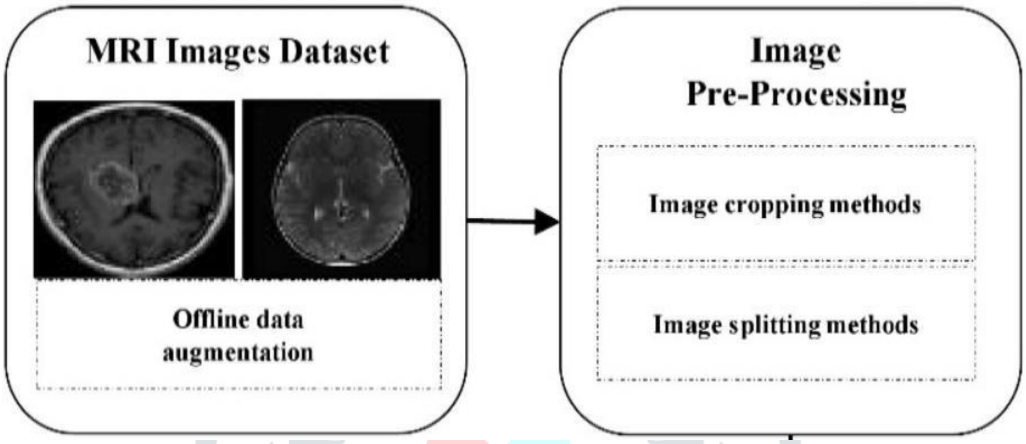


Figure: 2 Image Preprocessing

In image preprocessing (fig:2), image acquisition is done by retrieving an image from dataset for processing. It is the first step in the workflow sequence because, without animage no processing is possible. The image that is acquired is completely unprocessed.Here we process the image using the file path from the local device.

5.1 CONVERT THE IMAGE FROM ONE COLOR SPACE TO ANOTHER:

There are more than 150 color-space conversion methods available in OpenCV.For color conversion, we use the function cv2.cvtColor(input_image, flag) where flag determines the type of conversion. In our work, we convert the input image into the gray-scale image.

- **FILTERS:** In image processing, filters are mainly used to suppress the high frequencies inthe image. It is a non-linear filtering technique used to remove noise from the images. It is performed by sorting all the pixel values fromthe window into numerical order and then replacing the pixel being considered with the median pixel value. This filter removes the speckle noise and salt and pepper noise through 'ON' and'OFF' of pixels by white and dark spots.

6 TUMOR

A tumor or tumor is the name for a neoplasm or a solid lesion formed by an abnormal growth of cells (termed neoplastic) which looks like a swelling. Tumor is not synonymous with cancer. A tumor can be benign, pre-malignant or malignant, whereas cancer is by definition malignant.

6.1 IMAGE SEGMENTATION USING DATA AUGMENTATING

Data augmentation algorithms for brain-tumor segmentation from MRI can be divided into the following main categories (which we render in a taxonomy presented) the algorithms exploiting various transformations of the original data, including affine image transformations, elastic transformations, pixel level transformations. In the affine approaches, existent image data undergo different operations (rotation, zooming, cropping, flipping, or translations) to increase the number of training examples (Pereira et al., 2016; Liu et al., 2017). Shin et al. pointed out that such traditional data augmentation techniques fundamentally produce very correlated images (Shin et al., 2018), therefore can offer very little improvements for the deep-network training process and future generalization over the unseen test data (such examples do not regularize the problem sufficiently). Additionally, they can also generate anatomically incorrect examples, e.g., using rotation. Nevertheless, affine image transformations are trivial to implement (in both 2D and 3D), they are fairly flexible (due to their hyper-parameters), and are widely applied in the literature. In an example presented in Figure 3, we can see that applying simple data augmentation techniques can lead to a significant increase in the number of training samples.

7. PROPOSED WORKING

MRI image of the brain is processed for the detection of the tumor using Visual Studio Code. The proposed methodology employed here comprises of three stages. Initially pre-processing of given MRI image is done then edge detection of brain is conducted and finally, segmentation displays the tumor region.VGG-16 algorithm has also been implemented as an alternative method of CNN. displays other important tissues and edges along with the tumor region.

7.1 PROPOSED ALGORITHM FOR DETECTION OF BRAIN TUMOR

Step 1: Take MRI image of the brain as an input for the Testing Image Data Set.

Step 2: Convert it into equivalent grayscale image. Step 3: Apply filtering methods for removing noise.Step 4: Apply image enhancement techniques.

Step 5: Implement Image segmentation using Data Augmentation technique for proper detection of tumor region.

Step 6: Perform Convolution neural network Layers in VGG16 algorithms.

Step 7: Classify the Detection of Tumor or non-tumor using Streamlit Framework UI.

7.2 RESULTS

7.2.1 PERFORMANCE MEASURES:

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$

$$Specificity = \frac{TN}{TN + FP} \qquad Sensitivity = \frac{TN}{TP+FN}$$

7.2.2 PERFORMANCE EVALUTION:

Different set of Images	Precision (%)	Recall (%)	F1-Score (%)	Support
Normal Images	88.6	0.68	16.3	19.5
Tumor Images	87.4	86.1	81.6	30.0
Accuracy	88.7	-	87.9	50.3
Macro Avg	87.7	86.1	87.9	49.1
Weighted Avg	88.7	87.6	86.2	49.1

Table: 1 Represents the Precision, Recall, F1-Score and Support Values

Different set of Images	Accuracy (%)	Sensitivity (%)	Specificity (%)
244 * 244 Images	82.45	82.79	82.86
	85.85	85.36	86.62
	87.59	87.89	86.67

Table: 2 Represents the Accuracy, Sensitivity, and Specificity

```
Output exceeds the size limit. Open the full output data in a text editor
[INFO] compiling model...
[INFO] training head...
WARNING:tensorflow:From <ipython-input-21-9f4b4684741b>:9: Model.fit_generator (from tensorflow.python.keras.engine.training) is depr
Instructions for updating:
Please use Model.fit, which supports generators.
Epoch 1/25
24/24 [==============================] - 41s 2s/step - loss: 0.8164 - accuracy: 0.4896 - val_loss: 0.6063 - val_accuracy: 0.6122
Epoch 2/25
24/24 [==============================] - 43s 2s/step - loss: 0.6438 - accuracy: 0.6436 - val_loss: 0.5947 - val_accuracy: 0.6122
Epoch 3/25
24/24 [==============================] - 45s 2s/step - loss: 0.5474 - accuracy: 0.7074 - val_loss: 0.5526 - val_accuracy: 0.7959
Epoch 4/25
24/24 [==============================] - 43s 2s/step - loss: 0.5233 - accuracy: 0.7926 - val_loss: 0.5279 - val_accuracy: 0.8163
Epoch 5/25
24/24 [==============================] - 44s 2s/step - loss: 0.5163 - accuracy: 0.7447 - val_loss: 0.5103 - val_accuracy: 0.7959
Epoch 6/25
24/24 [==============================] - 45s 2s/step - loss: 0.4594 - accuracy: 0.7979 - val_loss: 0.5072 - val_accuracy: 0.7959
Epoch 7/25
24/24 [==============================] - 44s 2s/step - loss: 0.4821 - accuracy: 0.7606 - val_loss: 0.5047 - val_accuracy: 0.7959
Epoch 8/25
24/24 [==============================] - 43s 2s/step - loss: 0.4829 - accuracy: 0.7713 - val_loss: 0.4903 - val_accuracy: 0.7959
Epoch 9/25
24/24 [==============================] - 44s 2s/step - loss: 0.4278 - accuracy: 0.8245 - val_loss: 0.4838 - val_accuracy: 0.7755
Epoch 10/25
24/24 [==============================] - 45s 2s/step - loss: 0.4418 - accuracy: 0.7926 - val_loss: 0.4871 - val_accuracy: 0.7551
...
24/24 [==============================] - 47s 2s/step - loss: 0.3639 - accuracy: 0.8385 - val_loss: 0.4744 - val_accuracy: 0.8163
Epoch 25/25
24/24 [==============================] - 43s 2s/step - loss: 0.3429 - accuracy: 0.8837 - val_loss: 0.4627 - val_accuracy: 0.8751
[INFO] training complete.
```

Figure :3 Training Data Results

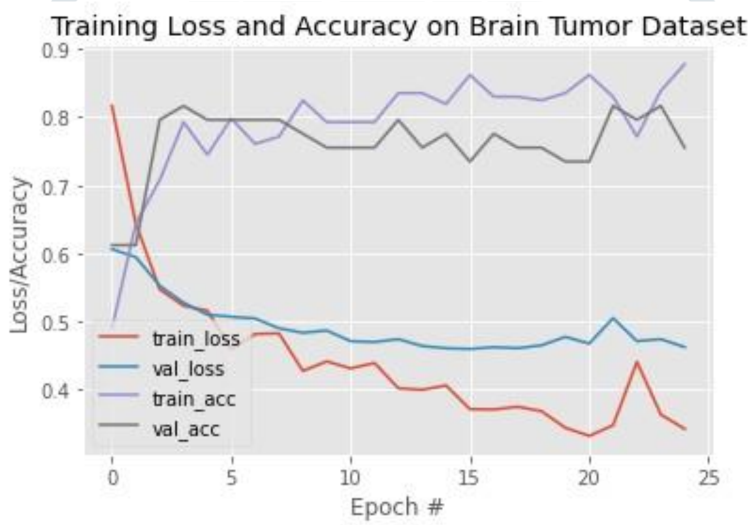


Figure:4 Accuracy & Loss Graph

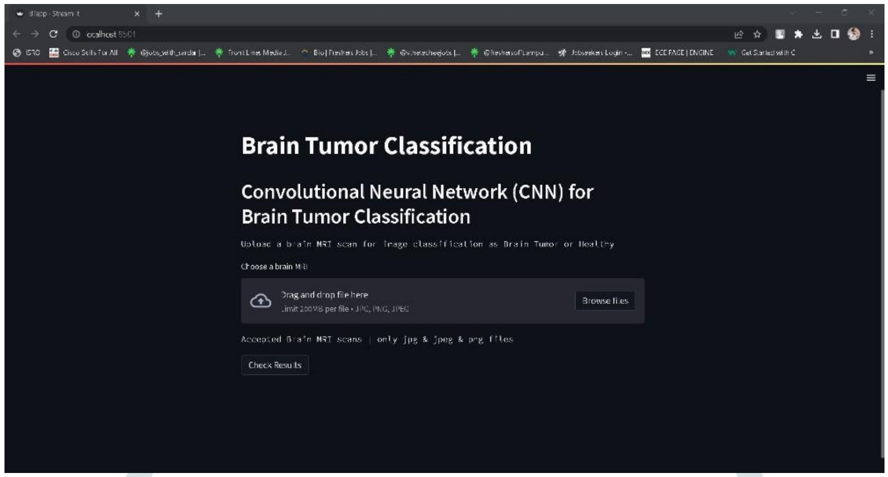
7.3 STREAMLIT APP COMMANDS TO RUN THE SERVER

```
PS D:\project\Brain-Tumor-Classification-main> streamlit run BTapp.py

  You can now view your Streamlit app in your browser.

  Local URL: http://localhost:8501
  Network URL: http://192.168.1.9:8501
```

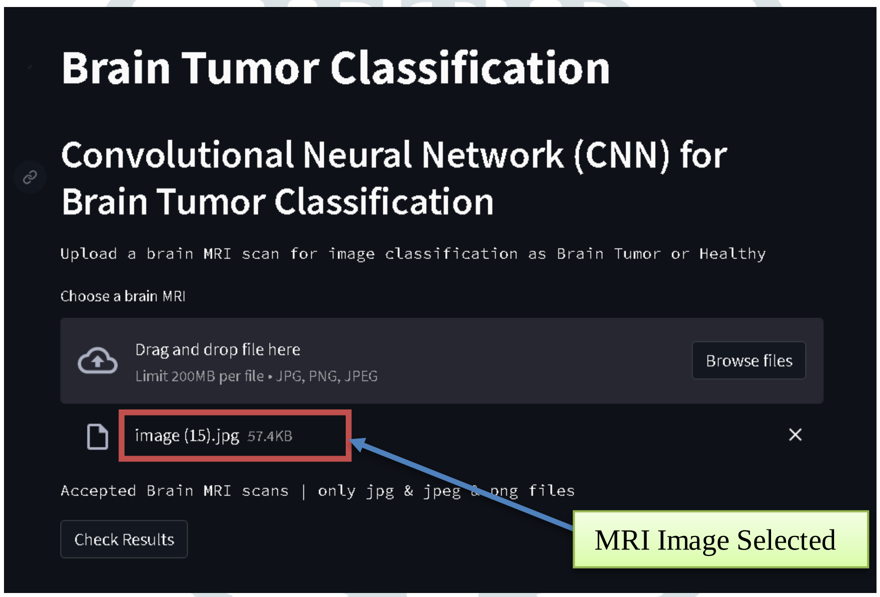
Fig:5 Streamlit Commands

8. SCREENSHOTS

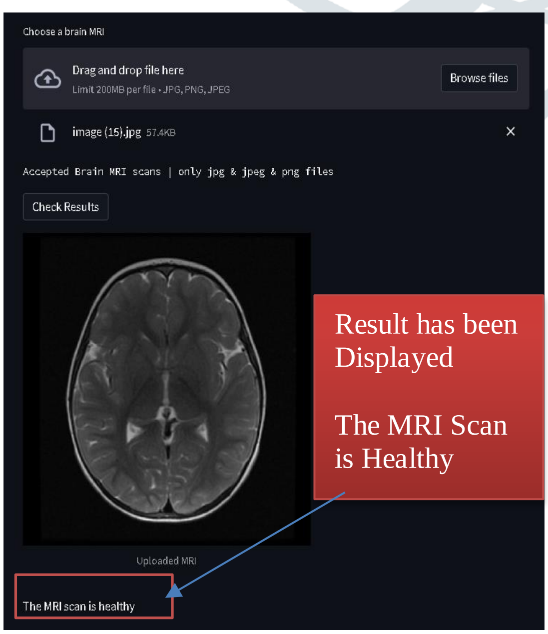
1



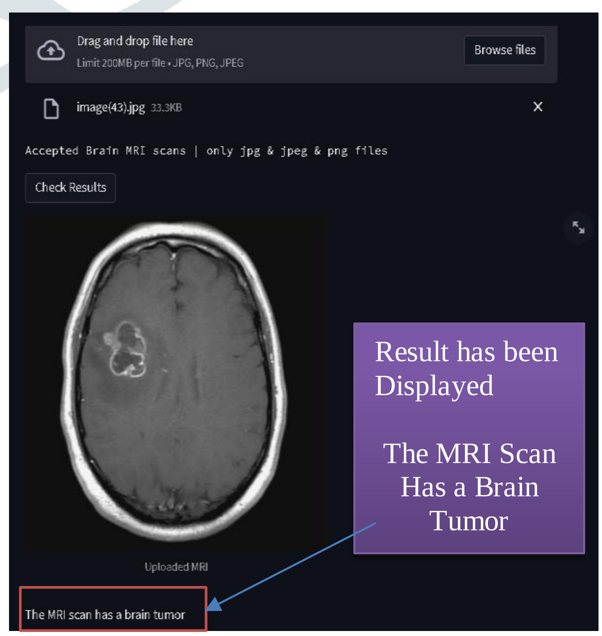
2



3



4



9. CONCLUSION

We proposed a computerized method for the segmentation and identification ofa brain tumor using the Convolution Neural Network. The input MR images are read from the local device using the file path and converted into grayscale images. These images are pre-processed using an adaptive bilateral filtering technique for the elimination of noises that are present inside the original image. The binary thresholdingis applied to the denoised image, and Convolution Neural Network segmentation is applied, which helps in figuring out the tumor region in the MR images. The proposed model had obtained an accuracy of 88% and yields promising results without any errorsand much less computational time.

10. REFERENCE

[1] Sivaramakrishnan And Dr.M.Karnan "A Novel Based Approach For Extraction Of Brain Tumor In MRI Images Using Soft Computing Techniques," International Journal Of Advanced Research In Computer And Communication Engineering, Vol. 2, Issue 4, April 2013.

[2] Asra Aslam, Ekram Khan, M.M. Sufyan Beg, Improved Edge Detection Algorithm for Brain Tumor Segmentation, Procedia Computer Science, Volume 58,2015, Pp 430-437, ISSN 1877-0509.

[3] Mahmoud, Dalia & Mohamed, Eltaher. (2012). Brain Tumor Detection Using Artificial Neural Networks. Journal of Science and Technology. 13. 31-39.

[4] Monica Subashini.M, Sarat Kumar Sahoo, "Brain MR Image Segmentation for Tumor Detection using Artificial Neural Networks," International Journal of Engineering and Technology (IJET), Vol.5, No 2, Apr-May 2013.

[5] S. Pereira, A. Pinto, V. Alves, and C. A. Silva, "Brain Tumor Segmentation Using Convolutional Neural Networks in MRI Images," in IEEE Transactions on Medical Imaging, vol. 35, no. 5, pp. 1240-1251, May 2016.

[6] S. Pereira, A. Pinto, V. Alves, and C. A. Silva, "Brain Tumor Segmentation Using Convolutional Neural Networks in MRI Images," in IEEE Transactions on Medical Imaging, vol. 35, no. 5, pp. 1240-1251, May 2016.

[7] Sankari, Ali, and S. Vigneshwari. "Automatic tumor segmentation using convolutional neural networks."2017 Third International Conference on Science Technology Engineering & Management (ICONSTEM) (2017): 268-272.

[8] Sergio Pereira, Adriano Pinto, Victor Alves, and Carlos A. Silva –Brain Tumor Segmentation Using Convolutional Neural Networks in MRI Images ‖IEEE TRANSACTIONS ON MEDICAL IMAGING, VOL.

[9] P.S. Mukambika, K Uma Rani, "Segmentation and Classification of MRI BrainTumor," International Research Journal of Engineering and Technology (IRJET), Vol.4, Issue 7, 2017, pp. 683 – 688, ISSN: 2395-0056