International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 4 Apr 2022, pp: 41-45 www.ijaem.net ISSN: 2395-5252

Brain Tumor Detection using Deep Learning

Sadaf Aafreen[1], Iqura Zarreen[2], Aftab Ahemad[3], Prof. Abdul Razzaque[4]

[1,2,3] *Students, Anjuman College of Engineering and Technology, Nagpur, Maharashtra*
[4] *Associate Professor, CSE Department, Anjuman College of Engineering and Technology, Nagpur, Maharashtra*

Submitted: 01-04-2022 Revised: 04-04-2022 Accepted: 07-04-2022

ABSTRACT: This research paper is to detect Brain Tumor using Deep Learning. A brain tumor is a disease caused due to the growth of abnormal cells in the brain. There are two main categories of brain tumor, they are non-cancerous (benign) brain tumor and cancerous (malignant) brain tumor. With the growth of Artificial Intelligence, Deep learning models are used to diagnose the brain tumor by taking the images of Magnetic Resonance Imaging (MRI). The research work carried out uses Deep learning models like convolutional neural network (CNN) model to detect the tumor region in the scanned brain image. Convolutional Neural Network (CNN) was employed for the task of classification.we have concentrate on deep learning through brain tumor detection using normal brain image or abnormal by using deep learning. The brain is largest and most complex organ in human body that works with billions of cells. The convolutional neural network algorithm is used to detecting the brain tumor. There are many existing techniques are available for brain tumor segmentation and classification to detect the brain tumor. There are many techniques available presents a study of existing techniques for brain tumor detection and their advantages and limitations. To overcome these limitations, we used Convolution Neural Network (CNN) based classifier. CNN based classifier used to compare the trained data and test data, from this data get the best result.

KEYWORDS: CNN, MR Images, transfer learning, Deep Learning, Brain tumor etc.

I. INTRODUCTION

A Brain Tumor is a mass of tissue in which the cells multiply uncontrollably. It arises from different cells - both in the brain and outside. Tumors can have different origins and based on the cells or the origin obtained from different types of tumors. Symptoms of a brain tumor include headache which can be acute and persistent, muscular disorders, cognitive disorders, etc.

The presence of tumor is noticed by the Magnetic Resonance Imaging [MRI] scanning. The MRI scanning should be diagnosed by the physician and later based on the results; the treatments shall be started. In recent times, Computer-aided diagnosis of diseases is gaining interest and is helping doctors take swift decisions. One such approach is using Convolutional Neural Networks (CNN) to learn the spatial and temporal features from the given dataset which are necessary to identify the disease. Convolutional Neural Network (CNN) was employed for the task of classification. we have concentrate on deep learning through brain tumor detection using normal brain image or abnormal by using deep learning. The convolutional neural network algorithm is used to detecting the brain tumor.

The proposed technique has used CNN to identify and categorize the tumor from brain images of the brain. The main difference between the main channel of the neural network with the normal neural network is that it is able to automatically and locally extract the feature from each image. These types of networks consist of neurons with weights and biases that can be learned. A Convolutional Neural Network is a special type of neural network which specializes in handling image datasets. The very fundamental principle of this neural network is performing a convolution operation between the kernel and the image to extract the features.

Here we are detecting Brain tumor from MR Images. There is an image dataset consisting

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 4 Apr 2022, pp: 41-45 www.ijaem.net ISSN: 2395-5252

some MR Images of healthy brain and some Images containing brain tumor. Following are some MR Images.

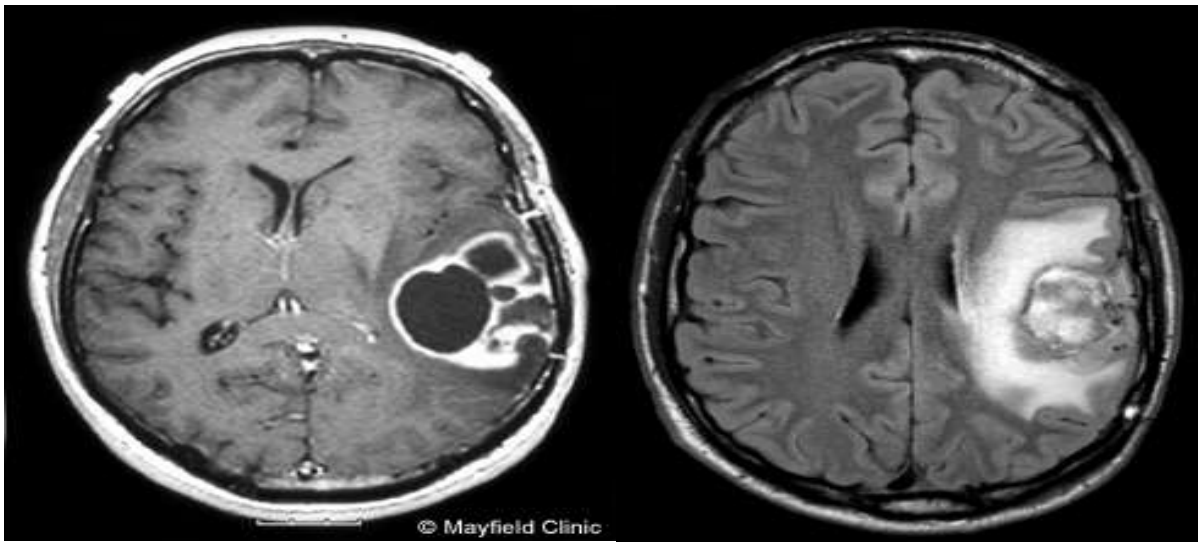

Fig: Magnetic Resonance Image (MRI) consisting Brain tumor[1]

DEEP LEARNING :

Deep learning[2] is a type of machine learning and artificial intelligence (AI) that imitates the way humans gain certain types of knowledge. Deep learning is an artificial intelligence (AI) function that initiates the workings of the human brain in processing data and creating patterns for use in decision making.

In ML Algorithms everything is flatten and in single dimension array but whereas in deep learning we use some think called as tenser and tenser has basically small matrices inside a big matrix, so it can be consider as matrix nested at inside a matrix

Deep learning is an important element of data science, which includes statistics and predictive modeling. It is extremely beneficial to data scientists who are tasked with collecting, analyzing and interpreting large amounts of data; deep learning makes this process faster and easier. When there is lack of domain understanding for feature introspection, Deep Learning techniques outshines others as you have to worry less about feature engineering. Deep Learning really shines when it comes to complex problems such as image classification natural language processing, and speech recognition.

At its simplest, deep learning can be thought of as a way to automate predictive analytics. While traditional machine learning algorithms are linear, deep learning algorithms are stacked in a hierarchy of increasing complexity and abstraction.

CONCEPT OF PERCEPTRON :

The Perceptron[3] is a Deep Learning Algorithm that Allow to built a binary classification and a fun fact of perceptron That it is inspired by actual brain neuron. Just like a neuron in a body perceptron accept the multiple input in to the form of matrix and than based on a probability distribution value we can conclude which class to the belong. A Perceptron is an algorithm used for supervised learning of binary classifiers. Binary classifiers decide whether an input, usually represented by a series of vectors belongs to a specific class in short, a perceptron is a single-layer neural network.

Convolutional Neural Network (ConNet/DNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other.

A Convolutional Neural Network is a special type of neural network which specializes in handling image datasets. A convolutional layer is often coupled with a pooling layer and we can connect multiple such convolutional layer-pooling layer pairs. In the end, we can have few Dense layers and dropout layers for the final learning process.

TRANSFER LEARNING CONCEPT:

Transfer learning[4] for machine learning

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 4 Apr 2022, pp: 41-45 www.ijaem.net ISSN: 2395-5252

is when existing models are reused to solve a new challenge or problem. The knowledge developed from previous training is recycled to help perform a new task. The new task will be related in some way to the previously trained task, which could be to categorise objects in a specific file type. The original trained model usually requires a high level of generalisation to adapt to the new unseen data.

Transfer learning means that training won't need to be restarted from scratch for every new task. Training new machine learning models can be resource-intensive, so transfer learning saves both resources and time. The accurate labelling of large datasets also takes a huge amount of time. The majority of dataencountered by organisations can often be unlabelled, especially with the extensive datasets required to train a machine learning algorithm. With transfer learning, a model can be trained on an available labelled dataset, then be applied to a similar task that may involve unlabelled data.

II. LITERATURE REVIEW

Sneha Grampurohit[5]proposed work in which Deep neural networks such as CNN and VGG-16 are investigated on MRI images of Brain. Both the models have given an effectiveresult, However VGG-16 takes a greater computational time and memory but has given satisfactory results compared to CNN. Due to the availability of huge data being produced and stored by the medical sector, Deep learning will play an important role in data analysis in the upcoming days.

Sobhangi Sarkar[6],The paper discusses the method for detecting abnormalities in the brain MRI images. Sarkar discussed and implemented a deep learning architecture by leveraging convolutional neural networks for the classification of the different types of brain tumor from MR images. The model developed in the study plotted an accuracy of 91% and an overall precision and recall of 91% and 88% respectively.

Dr. ChintaSomeswararao[7], This paper was a combination of CNN model classification problem for predicting whether the subject has brain tumor or not & Computer Vision problem for automate the process of brain cropping from MRI scans. The final accuracy is much higher than 50% baseline (random guess). However, it could be increased by larger number of train images or through model hyper parameters tuning.

Amjad Rehman Khan[8],This article has exhibited a comprehensive brain tumor segmentation system and classification using VGG19 CNN model on MRI data. To enhance the accuracy of the classifier synthetic data, augmentation concept is introduced. The proposed technique first converts each input MR modality to slices, and intensities are preprocessed using a statistical normalization approach.K-means clustering approach is implemented to segment brain tumors to focus ROI for precise feature extraction. Finally, to classify brain tumors into their two general classes (benign/malignant); a finetuned VGG-19 CNN model is trained perfectly using synthetic data augmentation techniques. The proposed CNN based method is evaluated by conducting rigorous experiments on 2015 data set. Thus, the results show that the proposed technique could assist the radiologist and medical expertsin detecting brain tumors and classifying them into their respectiveclasses (benign/malignant). The proposed computer analysis'sefficiency and accuracy to design (CAD) system are comparedwith recent existing methods and the results exhibited that theproposed technique exhibited better accuracy.

ChirodipLodh Choudhury and ChandrakantaMahanty[9], In this research paper, They proposed a new system based on CNN, which discriminates between the Brain MRI images to mark them as tumorous or not. The model is having CNN with 3 layers and requires very few steps of pre-processing to produce the results in 35 epochs. The purpose of the research is to highlight the importance of diagnostic machine learning applications and predictive treatment. To detect brain tumour with neutrosophical principles in the future using the Convolutional Neural Network.

Janki Naik [10]discussed"Tumor Detection and Classification using Decision Tree in Brain MRI" is used to get accurate and efficient result. Using Decision tree classification technique tumor has been found as well as classified in Normal or Abnormal class. Here we used two algorithms, They developed brain tumor classification system is expected to provide valuable diagnosis techniques for the physicians.

Khurram Shahzad and Imran Siddique[11], proposed an easy, fully automatic and efficient algorithm for extraction of brain tumor has been introduced. Morphological operation like erosion and dilation along with morphological gradient and threshold are used. Morphological gradient is used for calculating threshold. Threshold is used to binarize the image which results an image having tumor and some noise with it. Erosion is used for thinning the image as it shrinks the image and helps to reduce noise or unwanted small objects. Dilation is being used after erosion so that to get removed tumor portion back which was being removed by erosion.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 4 Apr 2022, pp: 41-45 www.ijaem.net ISSN: 2395-5252

Aryan Sagar Methil,[12] This paper presents a novel method involving image processing techniques for image manipulation which would aid our CNN model to classify tumor and non-tumor images better. Image Processing techniques helped to solve the illumination issues and brought the tumor into focus. Data augmentation was used to reduce the chances of overfitting, as it artificially expands the size of a training dataset, thus bringing out an improvement in the performance and the ability of the model to generalize. There are limitations to this work as there are small chances that the image pre-processing applied can damage the information which makes a tumor image appear non-tumor in the eye of the CNN model.For future improvements, we can use ensemble techniques and combine the performance of different models for better performance.

Swathi K and Kishore Balasubramanian [13]propsed the automated segmentation techniques provide a wide range of applications like image guided surgery, volume visualization of regions of interest, medical diagnosis and serves an aid to detect other neurological diseases. Though automated, it requires verification of results from a doctor (to be certified by a competent medical professional before starting treatment). It is also seen that accuracy obtained by individual methods on an average is not convincing. Hybrid algorithms may reduce time complexity further, give accurate area of tumor occupied and aim in improving the accuracy, sensitivity and specificity

Masoumeh Siar and Mohammad Teshnehlab[14],In this paper they used the combination of feature extraction algorithm and the CNN for tumor detection from brain images is presented. The CNN is capable of detecting a tumor. The CNN is very useful for selecting an auto-feature in medical images. Images collected at the centers were labeled by clinicians, then, tumor screenings were categorized into two normal and patient classes.

IlyasseAboussaleh[15] proposed an approach based on CNN architecture in order to predict and segment simultaneously a cerebral tumor. In this process, an MRI image was pre-processed and augmented using normalization and data augmentation techniques. The MRI image was classified into a tumor or not tumor brain image by a CNN model with two neurons in the output layer; in this task,He used the ground truth to label the images as tumor or not tumor images. The segmentation was applied on the images that contained the tumor, using the features extracted from the last convolution layer of CNN architecture and gradients. Finally, Appliedpost-processing to improve our results.

GajendraRaut[16], In this paper the time-consuming process of brain tumor detection is thus simplified by automation. After detecting the tumor with convolutional neural networks segmentation techniques like autoencoders and K-means are applied over the tumorous image to locate the region of tumor in the image.when segmented the tumor image directly with K-means it sometimes produces a noisy poor segmented image. Hence for segmentation they combined Autoencoders with K-means which produced more precise and clear segmented images with less noise. Thus, an efficient model for detection and segmentation of brain tumor is build which saves human efforts and time.

G.Hemanth[17] proposed method employs a mean field term within the standard CNN objective function. The technique isdeveloped and applied in MATLAB environment byutilizing the image processing tool. Datasets areassembledfrom the UCI datasets. A comparison is portrayed among all the features and the entire result being depicted in thefigures. The accuracy is computed which is then compared with rest of the state-of-arts methods. Efficiency andtraining accuracy of the proposed brain tumorclassification approach is computed.

III. CONCLUSION

In this brain tumor detection we have studied about feature based existing work. In feature based we have study about image processing techniques likes image pre-processing, image segmentation, features extraction, classification. And also study about deep learning techniques CNN and VGG16.In this system we have detect the tumor is present or not if the tumor is present then model return's yes otherwise it return no. and we have compared CNN with the VGG 16 Model. The result of comparison VGG 16 is more accurate than CNN. However, not every task is said to be perfect in this development field even more improvement may be possible in this application. We have learned so many things and gained a lot of knowledge about development field.

IV. ADVANAGES

It has accuracy near about 95% using transfer learning concept. Our system will be fast and accurate fully automatic method for brain tumor detection.

Transfer learning has the benefit of decreasing the training time for a neural network model and can result in lower generalization error.

Useful Learned Features: The models have learned how to detect generic features from photographs, given that they were trained on more than 1,000,000 images for 1,000 categories.

State-of-the-Art Performance: The models achieved state of the art performance and remain effective on the specific image recognition task for which they were developed.

Easily Accessible: The model weights are provided as free downloadable files and many libraries provide convenient APIs to download and use the models directly.

V. APPLICATION

- The main aim of the applications is tumor identification.
- With the help of our project we can detect the brain tumor. This system Can assist the physicians to make early decision so that the treatment are carried out at an earlier stage.
- The reason behind the development of this application is to provide proper treatment as soon as possible and protect the human life which is in danger.
- This application is helpful to doctors as well as patient.
- The manual identification is not so fast, more accurate and efficient for user. To overcome those problem this application is design.
- It is user friendly application.

REFERENCES

[1]. Navoneel Chakrabarty "Brain MRI images dataset" [April 2019] https://www.kaggle.com/navoneel/brain-mri-images-for-brain-tumor-detection

[2]. Ed Burns "deep learning" [April 2021]https://www.techtarget.com/searchenterpriseai/definition/deep-learningdeepneuralnetwork#:~:text=Deep%20learning%20is%20a%20type,includes%20statistics%20and%20predictive%20modeling.

[3]. Simplilearn "What is Perceptron: A Beginners Guide for Perceptron" [February 2022]https://www.simplilearn.com/tutorials/deep-learning-tutorial/perceptron

[4]. Jason Brownlee "Transfer Learning in Keras with Computer Vision Models"[May 2019]https://machinelearningmastery.com/how-to-use-transfer-learning-when-developing-convolutional-neural-network-models/

[5]. Sneha Grampurohit "BRAIN TUMOR DETECTION USING DEEP LEARNING MODELS", IEEE [May 2020]

[6]. Sobhangi Sarkar "A CNN based Approach for the Detection of Brain Tumor Using MRI Scans" Research Gate [June 2020]

[7]. Dr. ChintaSomeswararao"Brain Tumor Detection Model from MR Images using Convolutional Neural Network" IEEMay[June 2020]

[8]. Amjad Rehman Khan "Brain tumor segmentation using K-means clustering and deep learning with synthetic data augmentation for classification" JMET [February 2020]

[9]. ChirodipLodh Choudhury and ChandrakantaMahanty "Brain Tumor Detection and Classification Using Convolutional Neural Network and Deep Neural Network" IEE [July 2020]

[10]. Janki Naik "Tumor Detection and Classification using Decision Tree in Brain MRI" IJERD [2013]

[11]. Khurram Shahzad and Imran Siddique "Efficient Brain Tumor Detection Using Image Processing Techniques "International Journal of Scientific & Engineering Research [December 2019]

[12]. Aryan Sagar Methil "Brain Tumor Detection using Deep Learning and Image Processing "IEE [June 2021]

[13]. Swathi K, Kishore Balasubramanian "Preliminary investigations on automatic segmentation methods for detection and volume calculation of brain tumor from MR images "Biomedical Research [February 2016]

[14]. Masoumeh Siar "Brain Tumor Detection Using Deep Neural Network and Machine Learning Algorithm"International Conference on Computer and Knowledge Engineering [October 2019]

[15]. IlyasseAboussaleh "Brain Tumor Segmentation Based on Deep Learning's Feature Representation" Jounral of Imaging [December 2021]

[16]. Gajendra Raut "Deep Learning Approach for Brain Tumor Detection and Segmentation" IEE [May 2021]

[17]. G.Hemanth"DESIGN AND IMPLEMENTING BRAIN TUMOR DETECTION USING MACHINE LEARNING APPROACH" IEE [August 2019].