iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 Issue: III Month of publication: March 2024

DOI: https://doi.org/10.22214/ijraset.2024.58808

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue III Mar 2024- Available at www.ijraset.com

A Literature Review on Brain Tumor Classification Using Deep Learning

Mrs. Saradha M[1], Agil V[2], Danesha M[3], Vignesh M[4]
Department of Computer Science and Engineering, KS Rangasamy College of Technology, Tiruchengode, Tamil Nadu, India

Abstract: Brain tumor detection is a hard process in medicine. These brain tumors were brought on by the development of defective brain cells. It is classified into benign and malignant tumor which is cancerous and non-cancerous. Brain tumors are divided into three types Glioma, Meningioma, and Pituitary Tumor. By using magnetic resonance images, brain tumor prediction is carried out quickly with greater accuracy when these algorithms are applied to MRI scans. This aids inpatient treatment. The radiologist can make speedy decisions thanks to these predictions. Deep learning is used to analyze enormous datasets and to create clear images of the body for brain tumor diagnosis. In the proposed work, the CNN algorithm is applied in the current model for computation accuracy as well as speed.
Keywords: Deep learning, CNN, Brain tumor detection.

I. INTRODUCTION

A brain tumor is a condition that results in abnormal brain growth. Frequently, the body produces a lot of new cells in a controlled manner to replace aging and damaged cells. In this manner, multiply and grow uncontrollably in brain tumors. MRI [Magnetic resonance image] is commonly used to obtain or detect the presence of cancer. The doctor can treat the patient based on the results of the MRI scan. This procedure will take some time. The current model uses CNN and VGG 16 to increase calculation accuracy and speed. They detect the feature automatically by combining several nerve-based algorithms. An abnormal growth in the brain is a symptom of a brain tumor. Brain tumor detection using MRI images in deep learning has several applications in the field of medical imaging and healthcare such as Early Detection in which Deep learningmodels can analyze MRI images to detect brain tumors at an early stage, before symptoms appear. This can improve patient outcomes by allowing for earlier treatment and potentially better outcomes.

Accurate diagnosis in Deep learning models can assist radiologists in accurately diagnosing brain tumors. They can identify subtle features that may be missed by human readers, leading to more accurate and consistent diagnoses. Treatment Planning can assist in treatment planning by providing detailed.

II. RELATED WORK

Mr. T. Sathies Kumar has proposed the use of Magnetic Resonance Imaging (MRI) as a non-invasive methodology for the detection of brain tumors. Early diagnosis is important for effective treatment, and MRI is a preferred imaging technique for this purpose. However, accurate detection of tumors in MRI images can be challenging, and their proposed system aims to accurately classify and segment tumor regions. The segmentation and 3D reconstruction of tumors can be helpful in the post-processing of the extracted region. Support Vector Machine (SVM) classifier and Artificial Neural Networks (ANN) to extract features and display the type of tumor. Their project also discusses various image processing techniques such as morphology, clustering, and image segmentation. The Classification Learner app is used for supervised machine learning, and the different types of classifiers used are SVM, K-Nearest Neighbors (K-NN), and decision tree.

A work by Aryan Sagar Methil is the challenges of medical professionals face in detecting brain tumors due to differing shapes, textures, and locations. It suggests using computer-aided diagnosis methods, specifically deep learning, and image processing, to improve detection accuracy. Their method involving the use of preprocessing techniques like histogram equalization and opening, followed by the applicationof a Convolutional Neural Network (CNN). The importance of appropriate image processing techniques in producing accurate results. To experiment and determine optimal techniques, the authors used a dataset of 4222 images with different tumor shapes, sizes, textures, and locations. The experimental study was carried on a dataset with different tumor shapes, sizes, textures, and locations. Convolutional Neural Network (CNN) was employed for the task of classification. In our work, CNN achieved a recall of 98.55% on the training set, 99.73% on the validation set which is very compelling.

A new method for accurate tumor segmentation and area calculation in brain MRI images by J.selvakumar. It consists of four modules: pre- processing, segmentation, feature extraction, and approximate reasoning. The pre-processing are the Steps involves filtering, noise removal, and reshaping of the image to enhance its quality. segmentation module uses a combination of K-Means and Fuzzy C-Means algorithms to group pixels based on specific characteristics. Their proposed method has important applications in the diagnosis, monitoring, and treatment of brain tumors. Future work could involve implementing the proposed system on a larger dataset and improving its efficiency. The project details the algorithms, mathematical representations, flowcharts, and output screenshots for the individual modules. Overall, their proposed system presents a promising approach to the accurate segmentation and area calculation of brain tumors in MRI images.

The comprehensive study on the use of machine learningand data mining techniques for detecting brain tumors at an early stage by author Mr. Hemanth. The detection of brain tumors is a crucial health issue, and early diagnosis and treatment can significantly improve survival rates. Their project discusses various approaches introduced by previous authors, such as automated segmentation, multi-fractal feature extraction, classification schemes, local independent projection-based classification, and ensemble classification. Their proposedmethodology involves the use of Convolutional Neural Networks (CNNs) for the automatic segmentation and classification of brain images, data pre-processing, average filtering, and pixel-based segmentation. The results obtained using the proposed methodology are compared to the existing state-of-art and other classification techniques, which suggest that the proposed method outperformsother techniques used in the literature.

The author Sneha Grampurohit has discussed the use of deep learning models to diagnose brain tumors by analyzing Magnetic Resonance Imaging (MRI) scans. The detection of brain tumors, which can assist physicians in making early decisions and starting treatments at an early stage. The dataset used in the study consists of MRI images of 253 patients, with 155 having tumorous images and 98 having non-tumorous images. To create the binary classification model, the researchers augmented the dataset, performed certain data pre-processing steps, and investigated two deep learning models: Convolutional Neural Network (CNN) and VGG-16 architecture. Their project work explains that brain tumors can be malignant or benign and survival rates are difficult to predict due to the different types of tumors. By automating the detection of brain tumors, the system has the potential to improve patient outcomes and treatment outcomes.

Mircea Gurbin research carries out the detecting and identifying support vector machines (SVMs). It discusses the different types of brain tumors and their importance in accurate diagnosis and prognosis. The author's proposed method involves denoising and submitting new MRI brain images for classification. The authors conclude that SVM with classify them as benign tumors, malignant tumors, or

healthy brains with high accuracy. They have computational advantages. Brain tumors are classified as benign or low-grade (grade 1 and 2) and malignant tumors or high-grade (grade 3 and 4). Their proposed methodology aims to differentiate between normal brain and tumor brain (benign or malign).

Nimra Nazeer (2020) has predicted the malignant vs. benign nature of brain tumors using machine learning classification models. Their study uses three classifiers: Support Vector Machine (SVM), Random Forest, and Naive Bayes classifiers, which are implemented using Python and trained and validated on a dataset obtained from Surveillance Epidemiology and End Results (SEER) for the years 1973-2015. The dataset was pre-processed and cleaned by removing irrelevant data, selecting, and standardizing relevant features, and normalizingnumerical data. The results shows that Naive Bayes predicted the nature of the tumor for all 10 data samples right. SVM predicted 9 results right, and Random Forest predicted right for 8 samples. The project highlights the importance of using machine learning models in cancer research and improving prognosis techniques.

III. PROPOSED METHODOLOGY

A. Architecture

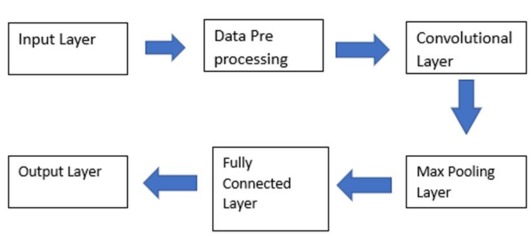


Figure 3.1 Flowchart of CNN

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue III Mar 2024- Available at www.ijraset.com

B. Dataset
A brain tumor is one of the more serious conditions that can affect both children and adults. Benign, malignant, and pituitary are some categories of brain tumors. Magnetic Resonance Imaging is the most effective method for finding brain cancers shown in Figures [3.1] & [3.2].

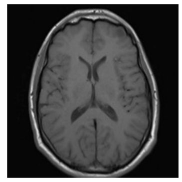
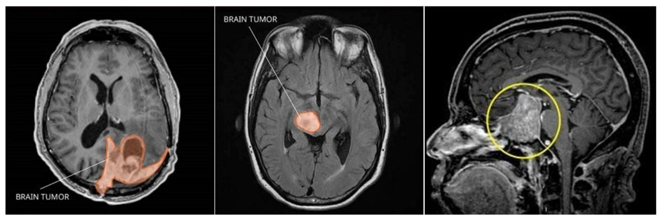


Figure 3.1 No Tumor MRI image



a) b) c)

Figure 3.2 Sample Dataset of Tumor images
a) Meningioma b) Glioma c) pituitary

C. Algorithm
It is a type of Artificial neural network. The image recognition and classification are very accurate in CNN. The important feature will be automatically detected. The advantage is, it will automatically learn the complex features of both the normal brain and the tumor brain tissues from the MRI images. So, it will improve the accuracy. CNN is generally used for finding patterns and recognizing objects, classes, and categories.

D. Procedure
The CNN algorithm is a deep learning model designed specifically for image recognition and processing tasks. CNNs are composed of multiple layers that work together to automatically extract relevant features from an input image and make predictions based on those feature

1) *Input:* It is noticed that the patient is completely healthy and capable of undergoing an MRI scan with the help of the doctor. The current study views a patient's brain MRI pictures as input.
2) *Data Preprocessing:* Data pre-processing is a technique that transforms raw data into usable data by using some pre-processing procedures.
3) *Convolutional Layer:* This layer applies a set of filters (also known as kernels) to the input image, which extracts features such as edges, textures, and shapes. Each filter produces a feature map that highlights a specific feature in the image.
   Output feature map = Input image(filter)
4) Zero padding: When applying a convolution, it must "pad" the image's borders in order to maintain the original image size. By using zero, it might "pad" the edges of our input so that the output volume equals the input volume.
5) The Rectified Linear Unit (ReLU), that carries out non-linear operations within the convolutional layer, as an activation function.

$$f(x) = \max(0, x)$$

where x is the input to the ReLU function. This function sets all negative values to zero.

6) Pooling operation: The pooling operation down-samples the output feature map from the convolutional layer.

$$Y_{ij} = \max(Z_{ij})$$

where Y_{ij} is the output of the pooling layer at position (i, j), and Z_{ij} is the input to the pooling layer at position (i, j).

7) The output layer finally gives the result of whether the MRI scan images are tumor or non-tumor.

E. Training and Testing Phase

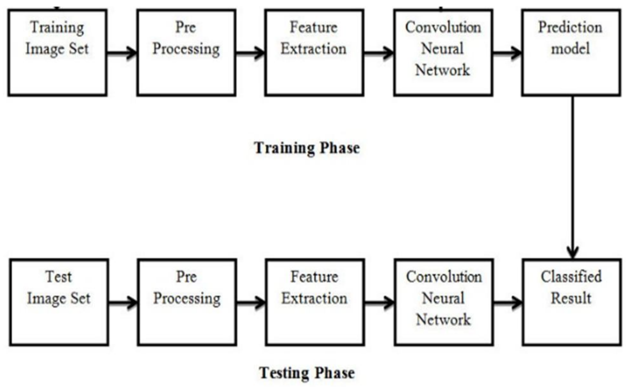


Figure 3.3 Flow diagram of the proposed Method

IV. EXPERIMENT AND RESULT

Convolutional Neural Networks (CNNs) have shown promising results for brain tumor detection in medical imaging. CNNs are a type of deep learning algorithm that isparticularly well-suited to image analysis tasks, such as those involved in medical imaging. CNN-based approaches to brain tumor detection have also been shown to be highly efficient. They can analyze large amounts of medical imaging data quickly, allowing for faster diagnosis and treatment of brain tumors.

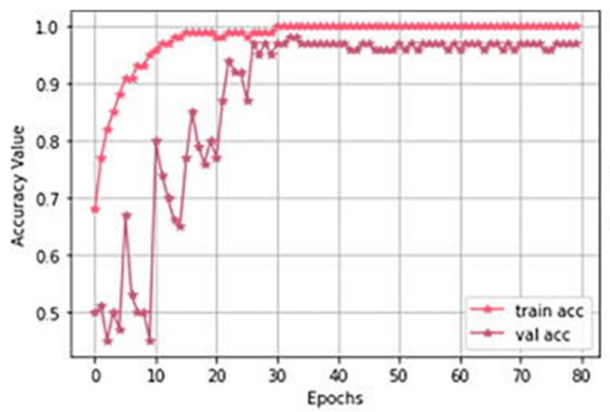


Figure 4.1 Accuracy value during training and validation process

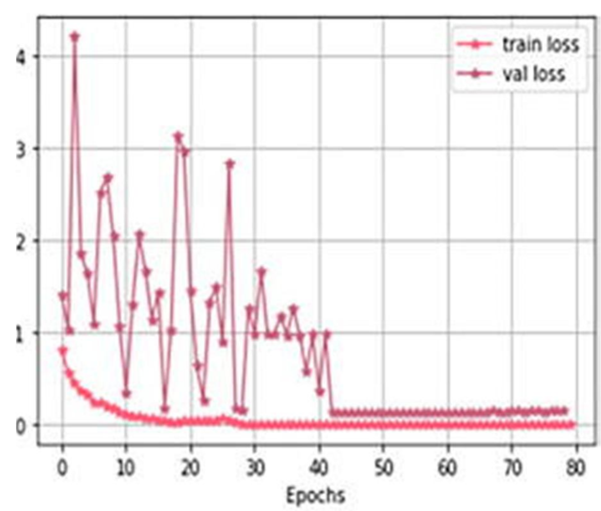


Figure 4.2 Loss value during the training and validation process

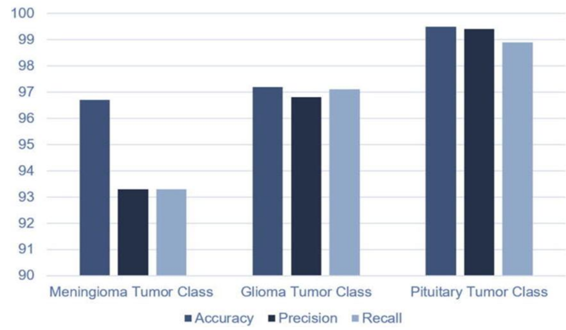


Figure 4.3 Comparison Graph

This shows each epoch's training and validation progress. Eventually, the CNN model reach 97.0% overall validation accuracy and 100% prediction accuracy. Furthermore, demonstrates how the loss value drops and eventually reaches zero for the training phase after some epochs.

V. CONCLUSION

The existing system of brain tumor classification has been reviewed. The segmented part will be trained to detect important features and used to compare the accuracy of different parts using a support vector machine and an artificial neural network. Thus, the proposed solution employs CNN and VGG, these types of methods being used for carrying out the various types of images by the method of preprocessing the images of brain tumor to detect whether tumor or non-tumor. Data augmentation not only expands the set of training datasets, but it also improves performance. The main benefit of data augmentation is that it reduces the possibility of overfitting.

REFERENCES

[1] Abdel-Halim Elamy, Maidong Hu," Mining Brain Tumors and Tracking their Growth Rates", Institute of Electrical and Electronics Engineers.

[2] Aditya miglani, Hrithick, Saurabh kumar ,"A ",literature review on brain tumor detection', Institute of Electrical and Electronics Engineers,2021.

[3] Amruta hebli, dr. sudha gupta, "Tumor Detection And Classification Of MRI Brain Image Using Different Wavelet Transforms And Support Vector Machines." , Institute of Electrical and Electronics Engineers, 25 July 2019, DOI: 10.1109/TSP.2019.8769040.

[4] Aryan Sagar Methil, "Brain Tumor Detection Using Deep Learning and Image Processing", Institute of Electrical and Electronics Engineers, 12 April 2021, DOI: 10.1109/ICAIS50930.2021.9395823.

[5] C. Hemasundara Rao, Dr. P.V. Naganjaneyulu, Dr. K. Satya Prasad," Brain tumor detection and segmentation using conditional random field", Institute of Electrical and Electronics Engineers,2017

[6] G.Hemanth, M.Janardhan,L.Sujihelen," Design and implementing Brain Tumor Detection using Machine Learning", Institute of Electrical and Electronics Engineers,2019.

[7] J.SelvaKumar,A.Lakshmi,T.Arivoli," Brain Tumor Segmentation and Its Area Calculation in Brain MR Images using K-Mean Clustering and Fuzzy C-Mean Algorithm", Institute of Electrical and Electronics Engineers,30,31 March 2012.

[8] M. Usman Akram', Anam Usman2," Computer Aided System for Brain Tumor Detection and Segmentation", Institute of Electrical and Electronics Engineers,11 July 2011.DOI: 10.1109/ICCNIT.2011.602.

[9] M. H. O. Rashid, M. A. Mamun, M. A. Hossain, M. P. Uddin, "Brain Tumor Detection Using Anisotropic Filtering, Svm Classifier And Morphological Operation From Mri Images", Institute of Electrical and Electronics Engineers, 20 September 2020, DOI: 10.1109/Ic4me2.2018.8465613.

[10] Mircea Gurbin, Mihaela Lascu," Tumor Detection and Classification of MRI Brain Image using Different Wavelet Transforms and Support Vector Machines",I nstitute of Electrical and Electronics Engineers,

[11] Meiyan Huang, Wei Yang, Yao Wu," Brain Tumor Segmentation Based on Local Independent Projection-based Classification", Institute of Electrical and Electronics Engineers,October 2014.

[12] Mr. T. Sathies Kumar, K. Rashmi Sreevidhya, Ramadoss, "Brain Tumor Detection Using Svm Classifier" Institute of Electrical and Electronics Engineers, 19 October2020, DOI: 10.1109/SSPS.2017.8071613.

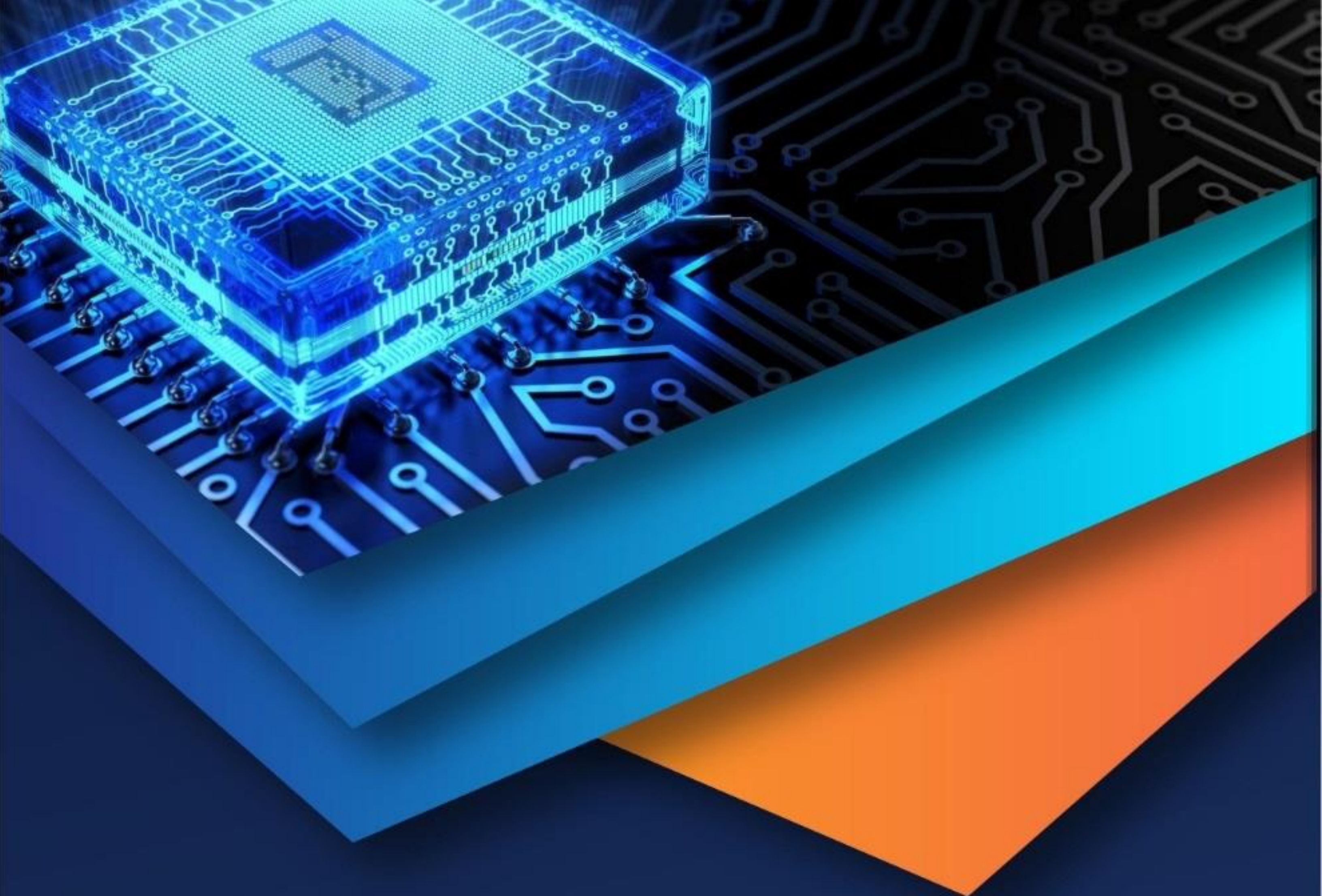
[13] Nitu Kumari, Sanjay Saxena ,"Review of Brain Tumor Segmentation andClassification", Institute of Electrical and Electronics Engineers, 29 November 2018, DOI: 10.1109/ICCTCT.2018.8551004.

[14] Nimra Nazeer, Dr. Bilal Wajid ," Prediction of Malignancy of Brain Cancer on SEER Dataset using Random Forest, SVM, and Naïve Bayes Classifiers", Institute of Electrical and Electronics Engineers.

[15] Se´rgio Pereira, Adriano Pinto, Victor Alves and Carlos A. Silva," Brain Tumor Segmentation using Convolutional Neural Networks in MRI Images", Institute of Electrical and Electronics Engineers, 2015 .10.1109/TMI.2016.2538465.

[16] Sneha Grampurohit, Venkamma Shalavadi, "Brain Tumor Detection Using Deep Learning Models", Institute of Electrical and Electronics Engineers, 08February2021, DOI: 10.1109/INDISCON50162.2020.00037.

[17] Sunil Kumar, Renu Dhir,Nisha Chaurasia,"Brain Tumor Detection Analysis Using CNN: A Review', Institute of Electrical and Electronics Engineers, 24 May 2021.



10.22214/IJRASET

INDEX COPERNICUS
45.98

ISRA JIF
IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL
IMPACT FACTOR:
7.429

ISI

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY