IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, March 2024

Brain Tumor Detection: Transfer Learning Approach with VGG-16

Dr. K. Kalaivani[1], V. Sravanthi[2], T. Ruhina Begam[3], H. Sai Anjana[4]
Assistant Professor, Department of Computer Science and Engineering[1]
Students, Department Computer Science and Engineering[2,3,4]
VELS Institute of Science, Technology and Advanced Study (VISTAS), Pallavaram, India
kalai.se@velsuniv.ac.in[1], vademsravanthi@gmail.com[2], tuhinahussain425@gmail.com[3],
harianjana85@gmail.com[4]

Abstract: *Brain tumors have a profound impact on individuals worldwide, necessitating early detection to improve patient outcomes. This study explores the potential of deep learning in facilitating early tumor detection to aid medical professionals in timely intervention and personalized treatment strategies. While current tumor detection methodologies rely on traditional imaging techniques and manual analysis, they may suffer from limitations in accuracy and efficiency. To address these challenges, we propose a novel method using the VGG-16 architecture, a powerful Convolutional Neural Network (CNN) model, with pre-trained weights for feature extraction. By harnessing the capability of VGG-16, our model effectively discerns tumor patterns from brain MRI scans. The dataset utilized for training and evaluation consists of Brain MRI Images for Brain Tumor Detection from Kaggle, featuring a diverse range of annotated scans. During the evaluation, we focus on the primary performance metric of accuracy, which measures the model's ability to precisely classify tumor and non-tumor cases. Through extensive experimentation and analysis, we critically assess the model's performance and its potential clinical applicability.*

Keywords: CNN, VGG-16, MRI, Brain Tumor Classification, Binary Classification, Accuracy, Data Augmentation, Medical Image Analysis etc

I. INTRODUCTION

The fields of "Image Classification" and "Deep learning" apply to this effort on the DETECTION OF BRAIN TUMOR. Although these two concepts are tightly linked and entwined, they can both be officially defined as the process of finding patterns in a big data set that are "useful."Abnormal growths of brain cells are known as brain tumors. They can appear gradually, and the first signs are sometimes confused with ordinary illnesses. Cognitive abilities decline with tumor progression, impacting daily duties and decision-making.Though there is no known treatment, following guidelines can help halt the disease's progression. An early and accurate diagnosis is essential to improving the quality of life for patients.

II . OBJECTIVE

Developing a reliable and accurate method for identifying brain cancers from medical imaging is the main objective of this study. We seek to improve the efficacy of our brain tumor detection model by leveraging the pre-trained VGG-16 neural network architecture and the capability of transfer learning. Prevent diagnostic errors that can occur from manual image examination. It enhances clinicians' ability to assess medical images, enabling them to diagnose patientsy. It enhances the ability of medical image analysis professionals to produce quicker and more precise diagnosis.

III . MACHINE LEARNING

A subfield of artificial intelligence (AI) and computer science called machine learning focuses on using data and algorithms to simulate how humans learn, gradually increasing the accuracy of the system. Machine learning is data driven technology. large amounts of data are daily produced by organizations. So, organizations make better decisions by seeing remarkable relationships in the data. The rapidly expanding discipline of data science includes machine

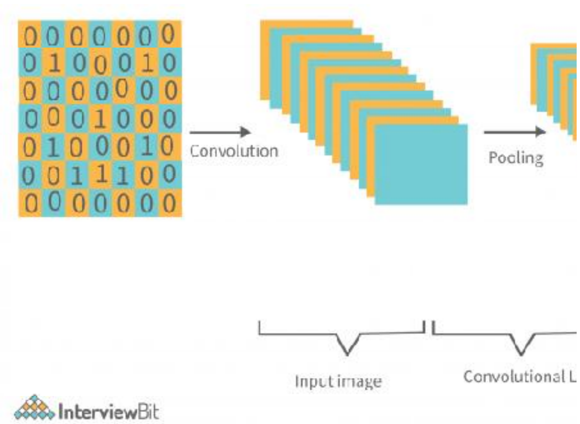
IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, March 2024

learning as a key element. Algorithms are trained using statistical techniques to produce classifications or predictions and to find important insights in data mining projects. Machine learning techniques enable computers to train on data inputs and make use of statistical analysis to produce values that fall inside a given range. In order to automate decision-making processes based on data inputs, machine learning enables computers to develop models from sample data.

IV. CONVOLUTIONAL NEURAL NETWORK (CNN)

A Convolutional Neural Network (CNN) is a class of deep neural networks that is particularly effective for image recognition and classification tasks. CNNs are inspired by the organization of the animal visual cortex and leverage a hierarchical structure to automatically learn and extract features from raw input data.CNNs have demonstrated state-of-the-art performance in various computer vision tasks, including image classification, object detection, segmentation, and more. Their ability to automatically learn hierarchical representations from raw data makes them well-suited for analyzing and extracting meaningful features from images, audio, video, and other types of structured data.

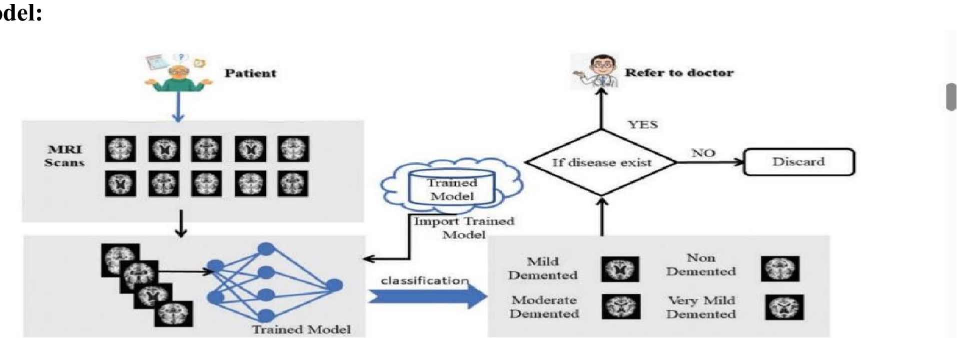
V. DENSE NEURAL NETWORKS ALGORITHM



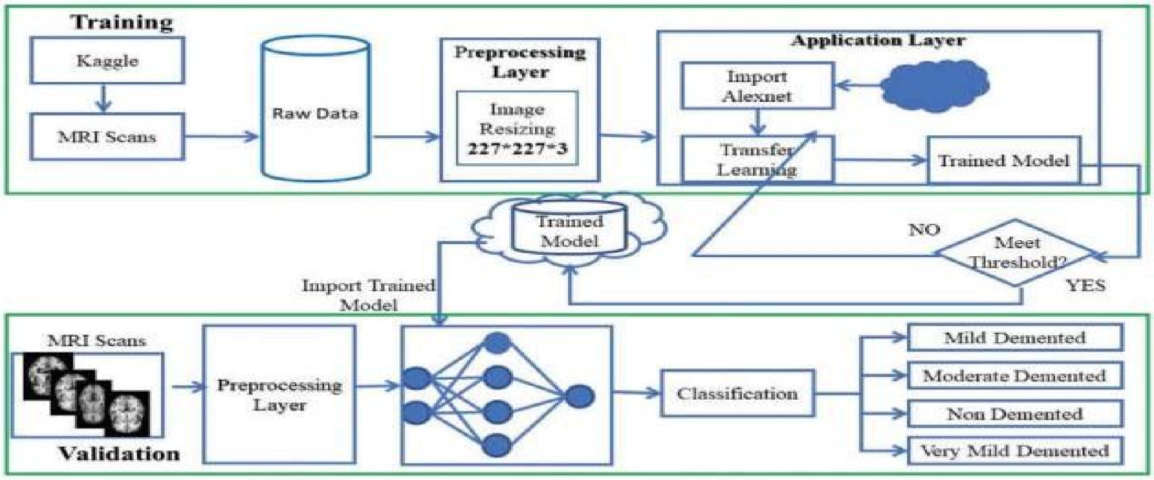
In the training phase, I utilized two primary deep learning frameworks: Convolutional Neural Networks (CNNs) and Dense Neural Networks. CNNs were employed for their superior ability to extract features from image data, making them ideal for tasks like image classification. On the other hand, Dense Neural Networks were chosen to capture complex relationships in the data, enabling the model to learn intricate patterns. For tumor segmentation, I implemented the U-Net algorithm, a specialized CNN architecture widely adopted in medical image analysis. U-Net's design is tailored to biomedical segmentation tasks, featuring an encoding path for capturing contextual information and a decoding path for precise localization. Its effectiveness, even with limited datasets, makes it a staple inmedical AI applications, particularly in tumor detection and segmentation.

VI. METHODOLOGY

System Model:



FUNCTIONAL ARCHITECTURE



ML involves using complex algorithms and models to analyze large amounts of data and identify patterns that can be used to detect the symtoms of brain tumor in future.

1. Setting up the Environment

Describing the software and hardware environment used for the project. We mention the programming languages and libraries employed, such as Python and TensorFlow.

2. Data Import and Preprocessing

Explaining how the dataset was obtained and its characteristics. Describing data preprocessing steps, including resizing, normalization, and handling missing data.Mention any ethical considerations regarding patient data.

3. Data Splitting

Data splitting refers to the process of dividing a dataset into multiple subsets for training, validation, and testing purposes in machine learning tasks. In the context of brain tumor detection using transfer learning with the VGG-16 approach, data splitting is crucial for assessing the model's performance and generalization ability

VII . CONCLUSION

The efficiency of transfer learning approaches in improving the deep neural network models' classification accuracy for brain tumor identification in MRI scans has been shown in this work. We performed capacity enhancement, fine-tuning, hyperparameter optimization, and data augmentation using the VGG-16 architecture as the foundational model. This allowed us to reach an excellent accuracy of 92% on the validation dataset and 80% on the test dataset.

REFERENCES

[1]. Dalmiya, A., &Manogaran, G. (2021). "Deep learning and artificial intelligence model for MRI brain tumor classification." Journal of King Saud University-Computer and Information Sciences.

[2]. Gupta, A., &Anjum, S. (2021). "Classification and segmentation of brain tumors using a convolutional neural network." In Innovations in Computer Science and Engineering (pp. 273-282). Springer.

[3]. Mourya, A., &Biswas, M. (2018). "Automated brain tumor detection and classification using convolutional neural networks." In Proceedings of the 2nd International Conference on Vision, Image and Signal Processing (pp. 11-20). ACM.

[4]. Islam, M. J., Zhang, Y., &LeCun, Y. (2018). "Brain Tumor Classification withSmall Sample Size Using Residual Networks." In 2018 IEEE 15th International Symposium on Biomedical Imaging (ISBI 2018) (pp. 1135-1139). IEEE.

[5]. Khalil, E., Soliman, A., El-Baz, A., &Gimelfarb, G. (2015). "Noninvasive brain tumor segmentation with a simple feature set for quantitative image analysis." In International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI) (pp. 21-28)