A Sturdy Artery for Brain Tumor Spotting Using Regulated Efficient Net

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ABSTRACT
A brain tumor is a disorder caused by growth of abnormal brain cells. The survival rate of a patient affected with a tumor is difficult to determine because they are infrequent and appear in various forms. These tumors can be identified through Magnetic Resonance (MRI) Images, which plays an essential role in determining the tumor site; however, manual detection is a time consuming and challenging procedure that can cause some errors in results, the adoption of computer-assisted approaches is essential to help in overcoming these constraints. With the advancement of artificial intelligence, deep learning (DL) models are being used in medical imaging to diagnose brain tumors using MR images. In this project, a deep convolution neural network (CNN) EfficientNet-B0 base model is fine-tuned with our proposed layers to efficiently classify and deduct brain tumor images. The image enhancement techniques are used by applying various filters to enhance the quality of the images, data augmentation methods are applied to increase the data samples for better training of our proposed model. The results show that the proposed fine-tune state-of-the-are EfficientNet-B0 out performs other CNN models by achieving the highest classification accuracy, precision, recall, and area under curve values surpassing other state-of-the-art models, with an overall accuracy of 98.87% in terms of classification and detection. Other DL algorithms such as VGG16, InceptionV3, Exception, ResNet50, and Inception ResNetV2 are used for comparative analysis.

Keywords: Brain Tumor, Regulated Efficient Net, Machine Learning.

I. INTRODUCTION

A brain tumor is adisorder caused by the development of abnormal cells or tissues in the brain. Cells generally reproduce and die in a regular sequence, with each new cell replacing the previous one. However, some cells become abnormal and continue to grow, causing severe damage to the brain functions, Aften leading to death. A minimum of 120 multiple times of brain tumors and the central nerves system (CNS)exists. According to the American Cancer Society,18600 adults and 3460 children under 15 will die due to brain and CNS tumors in2021.The 5-year survival rate for the patients having brain tumors is only 36%, and the 10-year survival rate is 31% [2]. Furthermore, National Cancer Institute reported 86,010 multiple cases of brain cancer and CNS cancers diagnosed in the United States in 2019. It was predicted that roughly 0.7 million people in the United States suffer from brain tumors .a total of 0.86 million cases were identified, of which 60,800 patients had benign tumors, and 26,170 patients had malignant tumors [3]. World Health Organization reported that 9.6 million people worldwide are estimated to have been diagnosed with cancer in 2018 [4].

One of the most significant aspects of saving a patient’s life is early brain tumor diagnosis.

The proper examination of brain tumor images is vital in evaluating a patient’s condition. The conventional method of detecting brain tumors includes a doctor or radiologist examiningmagnetic resonance (MR) images for anomalies and making decisions. However, it is strongly dependent on a doctor’s medical expertise; disparities in experience levels and nature of images create extra complexity for diagnosing with naked human eyes [5]. It is challenging for a doctor to interpret these images in a limited period since they contain several abnormalities or noisy data. As the volume of information increases, assessing a massive amount of information gets even more challenging. the manual detection of a brain tumor becomes more time-consuming and costly. Therefore, an automatic computer-aided diagnostic (CAD) system is required to assist doctors and radiologists in the timely detection of these deadly tumors to save precious human lives.

METHODOLOGIES

Dataset Description:
The dataset contained 3762MR images, 3060 were used as a subset, and 1500 were labelled as 1 (tumors). The other 1500 scans were labelled as 0 (non-tumor). In order to avoid class dominance, the dataset was equally divided between the two classes, with 80% (2400) of the images going for training and 20% (600) going for validation.

Data Preprocessing:
Preprocessing the images will transform the data into a standard classified format. In the first step, the images were converted to grayscale with a constant pixel resolution of 224*224. Second, the images were blurred using Gaussian blur to reduce noise and increase the output quality. These photos were then processed through a high pass filter, which sharpened the picture and allowed 15 the extraction of more complex features. Image processing techniques like erosion and dilation eliminate pixel intensities in too tiny regions to carry the structuring element.

Data Augmentation:
The effectiveness of most ML and DL models is determined by the quality, amount, and relevance of training data. However, one of the most prevalent problems in applying machine learning in organizations is a lack of data. It is due to the fact that gathering relevant data may be costly and time-consuming in many circumstances. Data augmentation is a series of methods for artificially increasing the quantity of data by producing additional data points from current data.

Experimental Setup:
The proposed model was deployed on the open-access dataset. The fine-tuned Efficient Net model was implemented in Python using the Keras and Tensor Flow frameworks as the foundation. First, we imported the pre-trained EfficientNet-B0 network from Keras and froze the beginning layers of the base model. In the second phase, fine-tuning was performed with our proposed ending layers with the brain tumor MR images, and the complete network was re-trained. The proposed and other CNN models were also compared to validate our experiment.

Performance Evaluation Metrics:
The confusion matrix (CM) is a standard method representing how well a trained model could predict a given validation dataset. The CM has equivalent rows and columns indicating the actual 16 class and the ground truth tables(i.e., tumors or non-tumors). Similarly, the predicated values represent the number of correct and wrong predictions or classifications for each validation sample.

III. LITERATURESURVEY

Title:“American Cancer Society’s report on the status of cancer disparities in the Unites States”

Authors: F. Islami, C.E.Guerra, A. Minihan, K.R. Yabroff, S.A. Fedewa, K. Sloan, T.L.Wiedt, B. Thomson, R.L. Siegel, N. Nargis, R.A. Winn, L. Lacasse.

Year: 2022

Description:

In this report, the authors provide comprehensive and up-to-date US data on disparities in cancer occurrence, major risk factors, and access to and utilization of preventive measures and screening by socio demographic characteristics. They also review programs and resources that have reduced cancer disparities and provide policy recommendations to further mitigate these inequalities. The overall cancer death rate is 19% higher among Black males than among White males. Black females also have a 12% higher overall cancer death rate than their White counterparts despite having an 8% lower incidence rate.

Title: “Deep learning for multigrade brain tumor classification in smart healthcare systems: A prospective survey”

Author: K. Muhammad, S. Khan, J.D.Ser, and V.H.C.D. Albuquerque

Year: 2021

Description:
Brain tumor is one of the most dangerous cancers in people of all ages, and its grade recognition is a challenging problem for radiologists in health monitoring and automated diagnosis. Recently, numerous methods based on deep learning have been presented in the literature for brain tumor classification (BTC) in order to assist radiologists for a better diagnostic analysis. In this overview, we present an in-depth review of the surveys published so far and recent deep learning-based methods for BTC. Our survey covers the main steps of deep learning-based methods, including preprocessing, features extraction.
SYSTEMARCHITECTURE

Fig: System Architecture

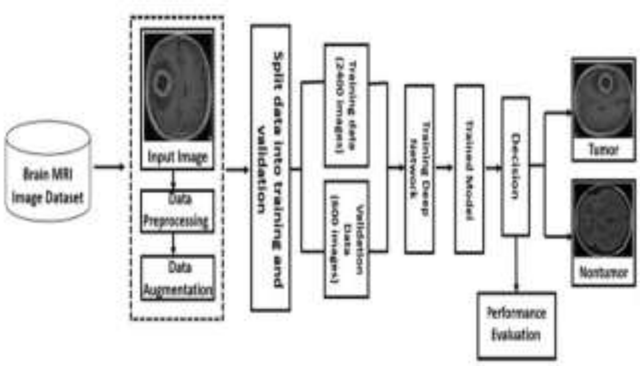

Fig: User login page

Fig: Admin login page

Fig: Doctors login page

Fig: Doctor Registration page

Fig: User Registration page

Fig: User Details

Fig: User Precautions page

CONCLUSION

MR imaging for the detection of brain tumor research has gained significant popularity because of the rising requirement for a practical and accurate evaluation of vast amounts of medical data. Brain tumors are a deadly disease, and manual detection is time-consuming and dependent on the expertise of doctors. An automatic diagnostic system will be required to detect abnormalities in MRI images. Therefore, this project developed an efficient, fine-tuned EfficientNet-B0 based transfer learning architecture to identify brain cancers from MRI scans. The proposed technique achieved the maximum performance in brain tumor detection, with 98.87% validation accuracy. Although this project focused on five other convolutional models and transfer learning designs forbrain tumors in the medical imaging field, further research is needed. We will investigate more significant and influential deep CNN models for brain tumor classification and conduct segmentation with reduced time complexity in future approaches.

FUTURE ENHANCEMENT

Using CNN models for brain tumor classification and conduct segmentation with reduced time complexity in future approaches. Also, to improve the accuracy of the proposed model, we will increase the number of MRI scans in the dataset used for this project.

REFERENCE

[1] D.Y.Lee, “Roles of mTOR signaling in brain development,”Experimental. Neurobiology., vol. 24, no. 3, pp.177-185, Sep.2015

[2] F. Islami, C.E.Guerra, A. Minihan, K.R. Yabroff, S.A Fedewa, K. Sloan, T.L.Wiedt, B.Thomson, R.L.Sigel, N. Nargis, R.A.Winn, L. Lacasse, L. Makaroff, E.C.Daniels, A.V.Patel, W.G.Cance, and A.Jemal, “American Cancer Society’s report on the status of cancer disparities in the United States, 2021,” CA, Cancer J. Clinicians, vol. 72, no. 2,pp.112-143, Mar.2022.

[3] Q.T. Ostrom, G. Cioffi, H. Gittleman, N. Patil, K. Waite, C.Kruchko, and J.S. BarnholtzSloan, “CBTRUS statistical report: Primary brain and other central nervous system tumors diagnosed in the United States in 2012-2016,” Neuro-Oncol.,vol.21,no.5, pp. v1-v100, Nov.2019.

[4] World Health Organization.(2021). Cancer. Accessed: Jan.23,2022.[Online]. Available: http://www.who.int

[5] G. Raut, J. Bhagade, and S. Gavhane, “Deep learning approach for brain tumor detection and segmentation,” in Proc. Int. Conf. Convergence in the Digital World: Quo Vadis (ICCDW), Feb.2020,pp.1-5.