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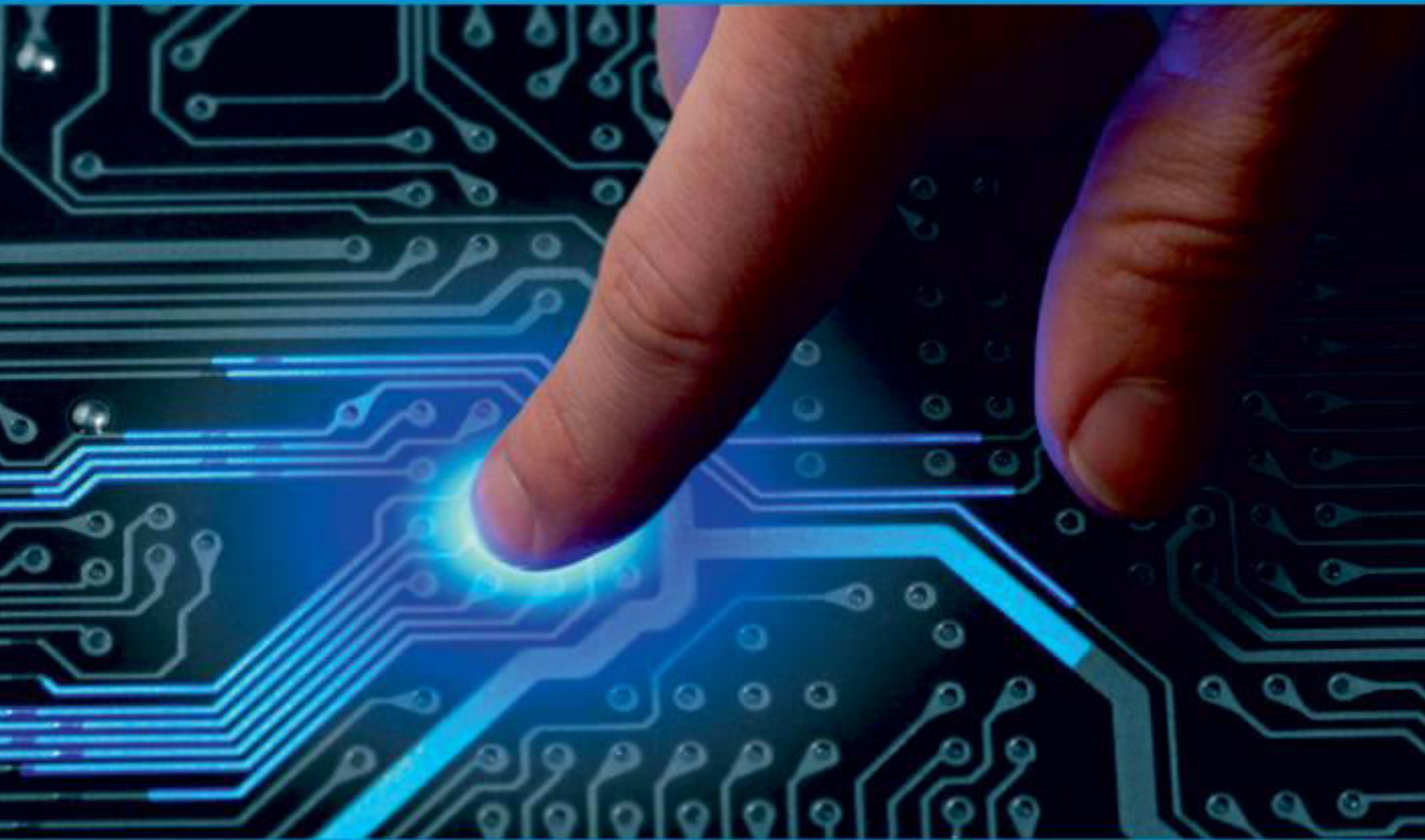

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Segmentation and Classification of Brain Tumor Using 3D-Unet Deep Neural Networks

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ABSTRACT: Early detection and diagnosis of a brain tumor enhance the medical options and the patient's chance of recovery. Magnetic resonance imaging (MRI) is used to detect and diagnose brain tumors. However, the manual identification of brain tumors from a large number of MRI images in clinical practice solely depends on the time and experience of medical professionals. Presently, computer aided expert systems are booming to facilitate medical diagnosis and treatment recommendations. Numerous machine learning and deep learning based frameworks are employed for brain tumor detection. This paper aims to design an efficient framework for brain tumor segmentation and classification using deep learning techniques. The study employs the 3D-UNet model for the volumetric segmentation of the MRI images, followed by the classification of the tumor using CNNs. The loss and precision diagrams are presented to establish the validity of the models. The performance of proposed models is measured, and the results are compared with those of other approaches reported in the literature. It is found that the proposed work is more efficacious than the state-of-the-art techniques.

KEYWORDS: Brain tumor segmentation, Brain tumor classification 3D U-Net Deep learning Convolutional neural network MRI Neural network

I.INTRODUCTION

Abnormal growth of cells or tissues in the brain can lead to a brain tumor. Neither the exact symptoms of a brain tumor nor the reasons that cause brain tumors are known today. Thus, people may be suffering from brain tumors without realising the gravity of the situation. It is of paramount importance to detect and extract the tumors at their early stages to save the patient's life. The MRI is an important tool for the detection, diagnosis, and monitoring of brain tumors. However, examining MRI scans is a dexterous, time-consuming, and difficult process. Further, it is very difficult to detect tumors manually, and the results may vary from one clinical expert to another based on their experience. Effective classification and segmentation of MRI images is quite challenging. The rationale is to build an expert system that would assist in the effective diagnosis of cancerous cells in MRI scans of the brain.

One of the most difficult aspects of dealing with MRI scans is that they are not 2D images like X-ray images. An MRI image is made up of several 3D volumes that show various parts of the brain. Until image segmentation, these 3D volumes are fused. When merging various channels of an MRI image, certain misalignments can occur, resulting in errors that can be corrected by image registration. Image registration is a technique for aligning images. Various machine learning and deep learning models for brain tumor prediction have been proposed recently. Many models for detecting, segmenting, and classifying brain tumors have been presented in the literature. For the segmentation of volumetric MRI scans, convolutional neural network architecture has been considered in this study. This research work focuses on the development of an effective model that can help in the accurate identification of tumors automatically. The proposed model is built on 3D-UNet convolutional neural networks that have been trained for tumor segmentation. The research is based on 3D segmentation of MRI scans. The volumetric MRI scans' 3D volume is divided into 3D sub-volumes, which are fed into the segmentation model and then recombined into a single 3D volume. The suggested method is useful since it effectively protects all aspects of the image while maintaining the image's volume. UNet architecture's effectiveness has also been extensively documented in the biomedical literature. The proposed work takes into account an image registration model, a 3D U-Net model, and finally a soft dice loss feature, all of which have been combined to form a comprehensive tumor detection model. The first move was to merge 3D image slices from an MRI scan into a single 3D model. Image registration corrects misalignment issues during mixing. The 3D model is divided into subsections after it has been developed. The subsections are then passed into the U-Net model, and the segmented model is obtained at the output after both down and up convolution cycles. The subsections are then merged once more to create a segmented 3D model, followed by the estimation of the loss function. After the volumetric segmentation of the tumor the next step is the classification of the brain tumors into meningioma, glioma, and pituitary

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tumors. Prior to feature extraction and sorting, most traditional brain tumor classification approaches included region-based tumor segmentation. CNN is made up of a convolutional neural network that performs automated segmentation and feature extraction, supplemented by a classical neural network that performs classification. A Rectified Linear Unit (ReLu), a convolution, and a pooling layer make up CNN's wellknown simple architecture. The abstract view of the proposed framework is presented in Fig. 1. The MRI images will be used as the input. The main phases of the proposed system are divided into four parts: i Data Collection ii Pre-processing iii Segmentation iv Classification Firstly, the collected images are subjected to the pre-processing module. The corrupted and blurred images are filtered in this module. For efficient and enhanced segmentation and classification, better segmentation and classification models are proposed in the research work. The major contributions of the paper are as follows: • The proposed framework incorporated the implementation of an advanced 3D U-Net model for volumetric segmentation and updated CNN for the classification of the MRI images, with the objective of creating an expert system for predicting brain tumors at an early stage. • The proposed segmentation and classification models are empirically evaluated using various evaluation metrics such as precision, recall, F score, dice similarity co-efficient, and support. • The loss and precision diagrams have also been used to establish the validity of the models. • The results are compared with the other approaches reported in the literature, and established as being more efficacious than the stateof-the-art techniques.

II. RESULT AND DISCUSSION

In the fig 1, it shows the actual image of a graphical user interface which we developed using python programming lanuage.

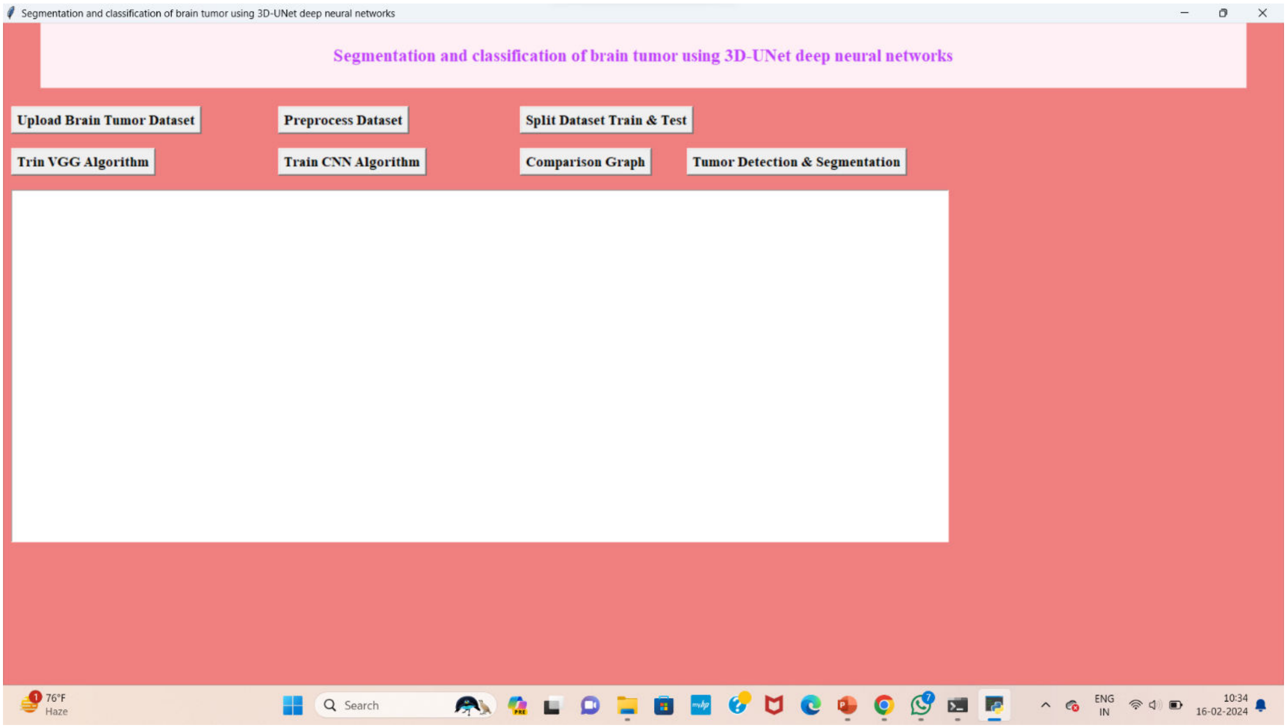

Fig. 1 Developed Graphical User Interface

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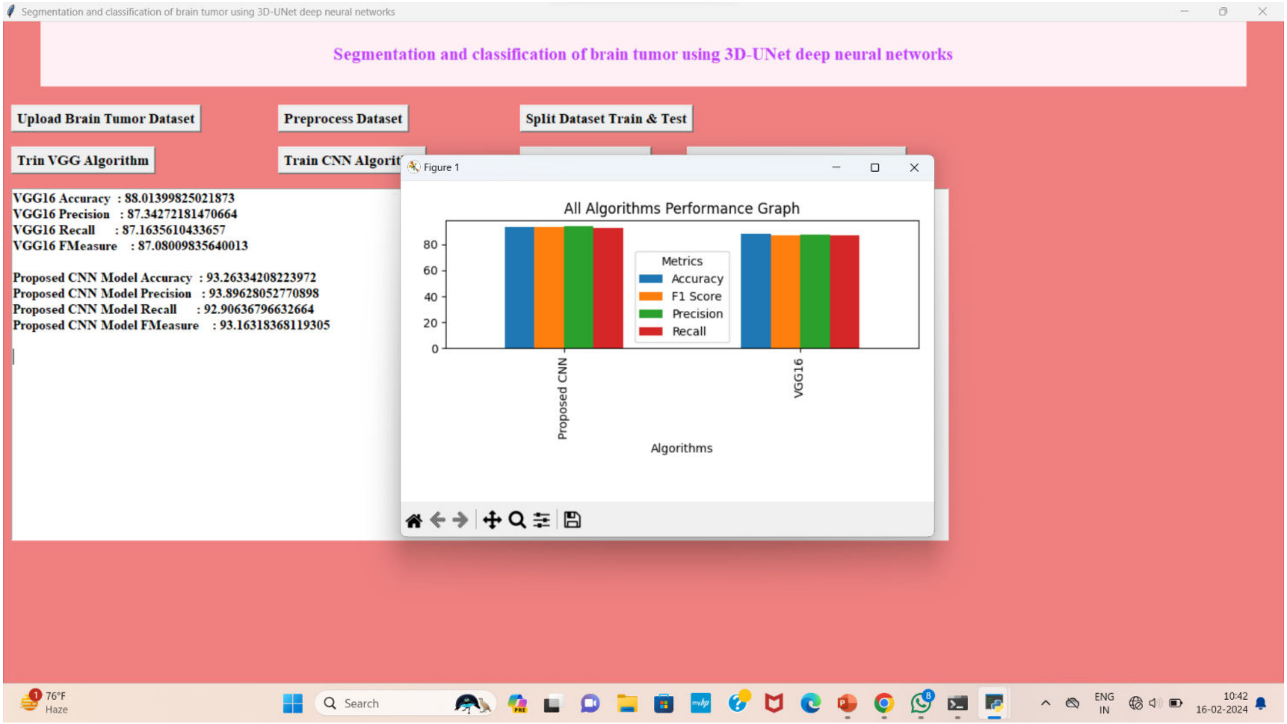

Fig. 2 Comparison Graph

In the fig 2, it shows the comparison graph between VGG and CNN algorithms. From the graph we come to know that Accuracy is high in CNN algorithm

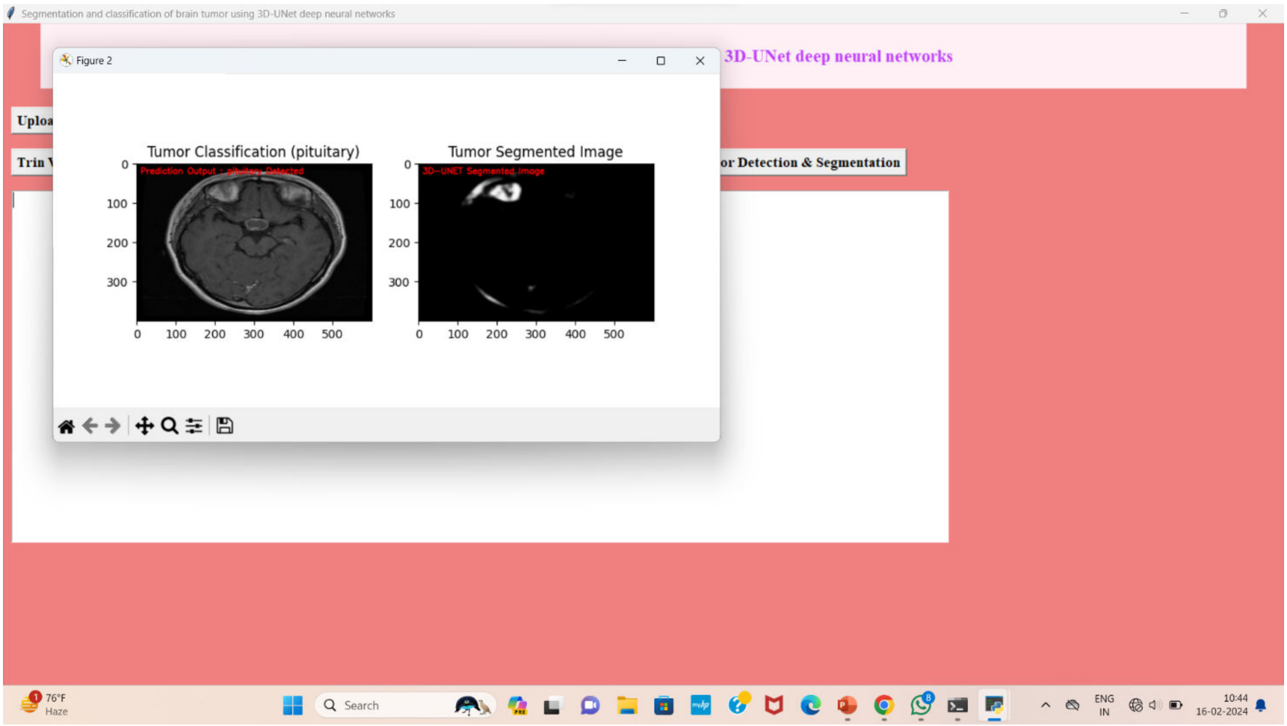

Fig .3 The segmented output

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In Fig 3,we can notice that when we give an MRI image it classifies the image and displays a segmented image where we come to know that which part is effected by which type of tumour.

III.CONCLUSION

In this study, segmentation and detection of brain tumor have been done using deep neural networks. In the present study, the MRI image dataset is used to train the neural network, and then soft dice loss is used to detect losses in the segmented model. Later, the model is trained, rectifying those losses and giving the segmented image as output. Initially, the 3D MRI model is divided into 3D sub-models to pass through the segmentation model. There are two datasets used for the CNN models. Every dataset is taken from different patients from different parts of the world to conquer the problem of generalization.

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