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# Detection and Classification of Tumors in Brain based on the Location by using MRI

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***Abstract: Brain tumor is a serious disease occurring in human being. Medical treatment process mainly depends on tumor types and its location. The final decision of neuro specialist and radiologist for the tumor diagnosis mainly depend on evaluation of MRI (Magnetic Resonance Imaging) images. To overcome this, Faster R-CNN deep learning algorithm was proposed for detecting the tumor and marking the area of their occurrence with Region Proposal Network (RPN). The selected MR image dataset consists of three primary brain tumors namely glioma, meningioma and pituitary. The proposed algorithm uses VGG-19 architecture as a base layer for both the region proposal network and the classifier network.***
***Keywords: Brain Tumor Detection, RPN, Faster R-CNN, VGG-19, MRI.***

## I. INTRODUCTION

Brain growth is a complex feature of brain tumors. Determining the optimal course of treatment and enhancing patient outcomes depend on an early and precise diagnosis. Accordingly, MRIs (Magnetic Resonance Imaging), which offer precise pictures of the structure and disorders of the brain, have emerged as a fundamental tool for brain diagnosis and behaviour. On the other hand, neuro specialists find that interpreting MRI scans takes a lot of time and leads to errors.

One characteristic of brain tumors is the abnormal development of brain cells. Meningiomas and pituitary tumors originating from the meninges are categorized as pituitary tumors, whereas gliomas are found in the brain or spinal cord. T1-weighted contrast-enhanced magnetic resonance imaging (MRI) scans can be used to aid in the detection and staging of brain tumors by distinguishing between the tumor and the surrounding brain tissue, edema, and cerebrospinal fluid, disparity in colour.

Diagnostic imaging is aided by a variety of imaging modalities, including computed tomography (CT), magnetic resonance imaging (MRI), and positron tomography (PET). Because of its efficacy and safety, magnetic resonance imaging (MRI) is the method of choice for brain diagnostics. Since MRI uses radio waves and magnets instead of radiation, there is no chance of radiation exposure for the body.light of this, the Faster R-CNN algorithm was used in order to identify and categorize brain cancers. VGG-19 serves as the basic network for the quicker R-CNN model. Gliomas, meningiomas, and pituitary tumors are the three types of brain tumors that the system was taught to identify.

## II. LITERATURE REVIEW

This evaluation of the literature emphasizes the challenges associated in independently identifying and classifying brain tumors from MRI scans, as noted by Kuraparthi S., Reddy, M.K., Sujatha, C.N., Valiveti, H., Duggineni, C., Kollati, M., and Kora, P [1]. Through the use of deep learning, namely Convolutional Neural Networks (CNNs), the study offers a novel strategy that integrates image enhancement techniques. When tested against benchmarked data and compared with pre-trained models, the recommended method achieved an excellent classification accuracy, demonstrating its potential to deliver accurate and efficient brain tumor diagnosis in medical practice..

Barjaktarovic, M.C., and Badza, M.M. [2], This paper provides a unique CNN architecture that is specifically meant for brain tumor classification, demonstrating its effectiveness and ease of use in contrast to pre-trained networks. The proposed CNN showed impressive accuracy on T1-weighted contrast-enhanced MRI images using record-wise cross-validation with augmented data, indicating its potential as a helpful decision-support tool for radiologists in medical diagnostics..

According to Bhanothu, Yakub, Anandhanarayan Kamalakannan, and Govindaraj Rajamanickam [3], brain tumors pose a significant risk to one's health, and the best treatment can only be obtained after a correct diagnosis.. Because manual MRI image evaluation is labor-intensive and prone to errors, automated methods are required.

By using Region Proposal Network (RPN) approaches to automate tumor detection and localization, the Faster R-CNN deep learning algorithm shows potential. The present study employs the VGG-16 architecture in the algorithm for both region proposal and classification tasks.

Gokila Brindha, P., Kavinraj, M., Manivasakam, P., and Prasanth, P.[4] proposes the brain tumors are typically detected through Magnetic Resonance Imaging (MRI) scans, which provide crucial information about abnormal tissue growth in the brain. Recent research has focused on leveraging Machine Learning and Deep Learning algorithms to enhance the detection of brain tumors. In the proposed work, a self-defined Artificial Neural Network (ANN) and Convolutional Neural Network (CNN) are applied to detect the presence of brain tumors, and their performance is thoroughly analyzed

Jia, Z., and Chen, D.[5] presents FAHS-SVM, a Fully Automatic Heterogeneous Segmentation strategy utilizing Support Vector Machine, which is based on deep learning techniques, in order to tackle this difficulty. This approach provides accurate segmentation of brain tumor areas and high uniformity distinction from adjacent anatomical components by integrating structural, morphological, and relaxometry information.

## III. PROPOSED METHOD

A system for automatic detection and classification of brain tumors was developed using the Faster R-CNN algorithm. VGG-19 is a deep learning algorithm that forms the basis of Faster R-CNN and is responsible for creating maps of brain scans and revealing tumor regions for analysis.

### *A. Image Data Preparation:*

The MR image dataset utilized in the proposed study comprises data, containing tumor images categorized into three classes: glioma, meningioma, and pituitary tumors. This dataset, accompanied by type and boundary information provided by radiologists, is accessible online. Prior to analysis, each image undergoes preprocessing.

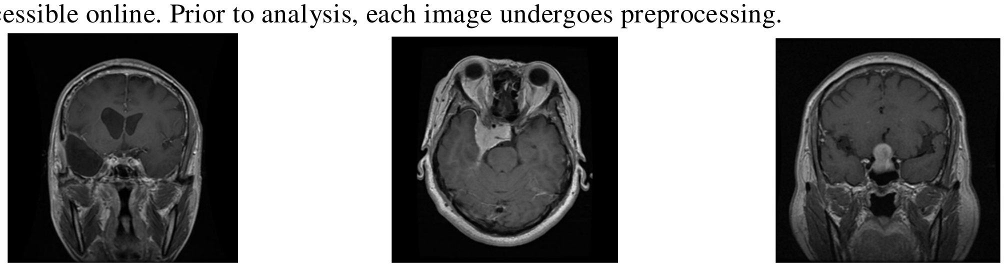

Fig.1 Three classes of tumors (Glioma, Meningioma, Pituitary)

### *B. Faster R-CNN Method:*

The Faster R-CNN architecture, is composed of three primary blocks:

1) *Region Proposal Network (RPN):* The RPN generates region proposals or candidate bounding boxes that potentially contain objects of interest within an image. It accomplishes this by sliding a small network, typically a convolutional neural network (CNN), over the image to predict regions likely to contain objects.
2) *Region of Interest (RoI) Pooling:* After obtaining region proposals from the RPN, RoI pooling is employed to extract fixed-size feature maps from each region proposal. This process ensures that the extracted features are consistent in size, regardless of the size or shape of the proposed regions.
3) *Region-based Convolutional Neural Network (R-CNN):* The extracted features from the RoI pooling stage are fed into a region-based CNN, which performs classification and bounding box regression tasks. This CNN is responsible for determining the presence of objects within the proposed regions and refining their bounding box coordinates.

Overall, the Faster R-CNN architecture integrates these three blocks to achieve efficient and accurate object detection by combining region proposal generation, feature extraction, and object classification/ into a unified framework.

## IV. IMPLEMENTATION DETAILS

Here we have gathered the images in Kaggle. Among the image set we have performed training and testing. After training few images are displayed by different categorical classes displaying the height and width of the image. At the time of testing, the trained model was used to detect the type of tumor. Here we have been used the VGG-19 as a base network, then the input image is initially processed by the central network, in this case it is rendered using the VGG-19 model.

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In particular, the input image is transferred to a fully connected processor via the VGG-19 architecture. The results of these operations are convolutional feature maps that encode high-level features extracted from the input image and can be used for a variety of tasks such as classification, detection or segmentation.

Generally, according to the VGG-19 model in the network, the input image is successfully extracted and transformed, and finally, a convolution feature map is created based on the body of the input image suitable for further processing.

## V. RESULTS

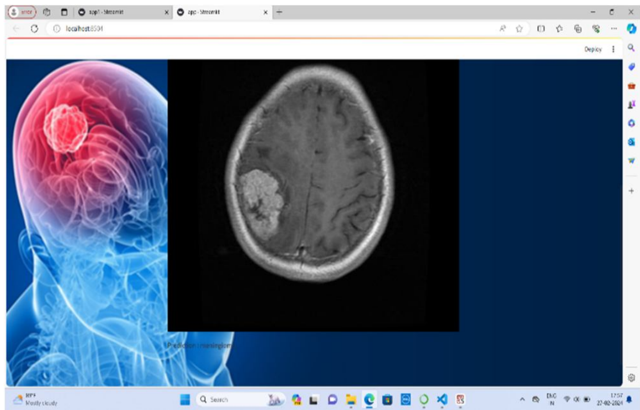

Fig.2 Prediction of Meningioma

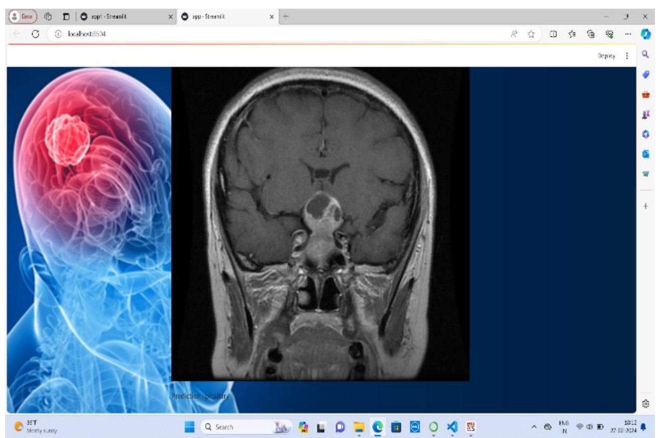

Fig.3 Prediction of Pituitary

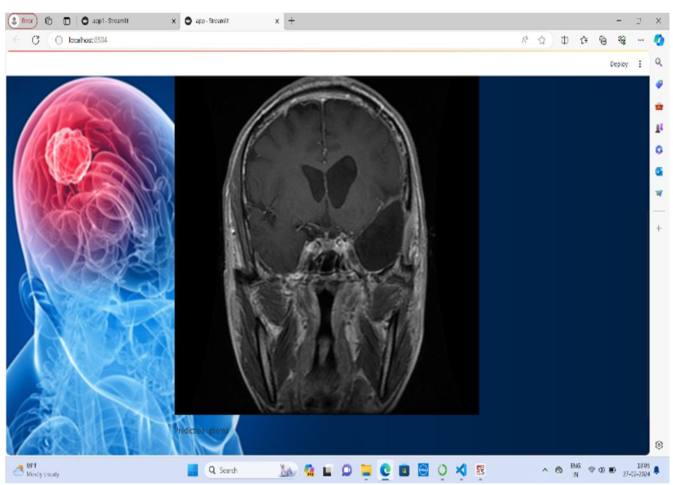

Fig.4 Prediction of Glioma

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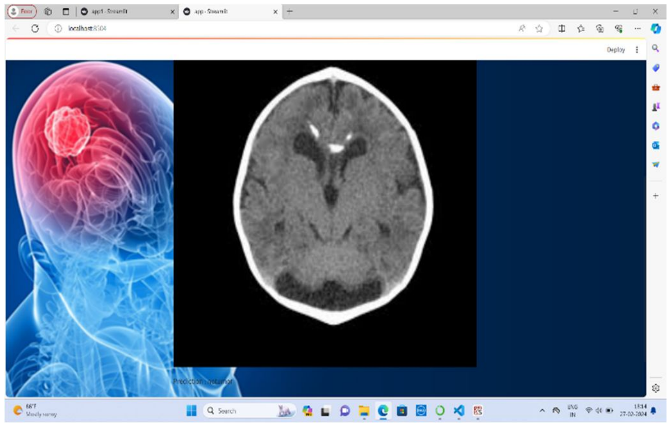
Fig.5 Prediction of No Tumor

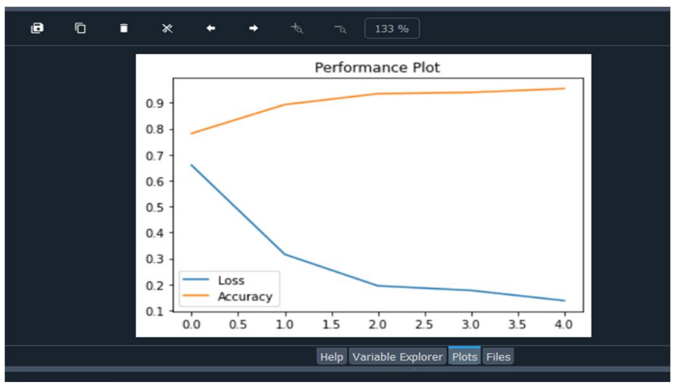

Fig.6 Performance Plot

## VI. CONCLUSION

In conclusion, the use of cutting-edge deep learning algorithms, specifically Faster R-CNN and VGG-19 as the base network layer. The algorithms have exhibited exceptional effectiveness in precisely identifying and categorizing brain cancers into discrete groups, such as gliomas, meningiomas, pituitary tumors, and non-tumor instances. The workload for radiologists and clinical specialists has been reduced because to the combination of Faster R-CNN and VGG-19 architectures, which have produced strong frameworks for automated tumor detection and classification. This allows for more individualized treatment plans and treatments.

Our method has shown encouraging results through rigorous testing and validation, attaining high tumor classification accuracy rates across several MRI datasets. The integration of VGG-19 and Faster R-CNN architectures allows for thorough MRI image analysis and interpretation, guaranteeing accurate brain tumor diagnosis and characterisation.

As these algorithms are developed further, they have the potential to completely transform the field of neuroimaging by providing less intrusive, quicker, and more accurate ways to identify and treat brain cancers. The application of deep learning techniques in clinical practice promises to enhance patient outcomes and expedite healthcare procedures as technology develops and datasets expand.

## VII. ACKNOWLEDGMENT

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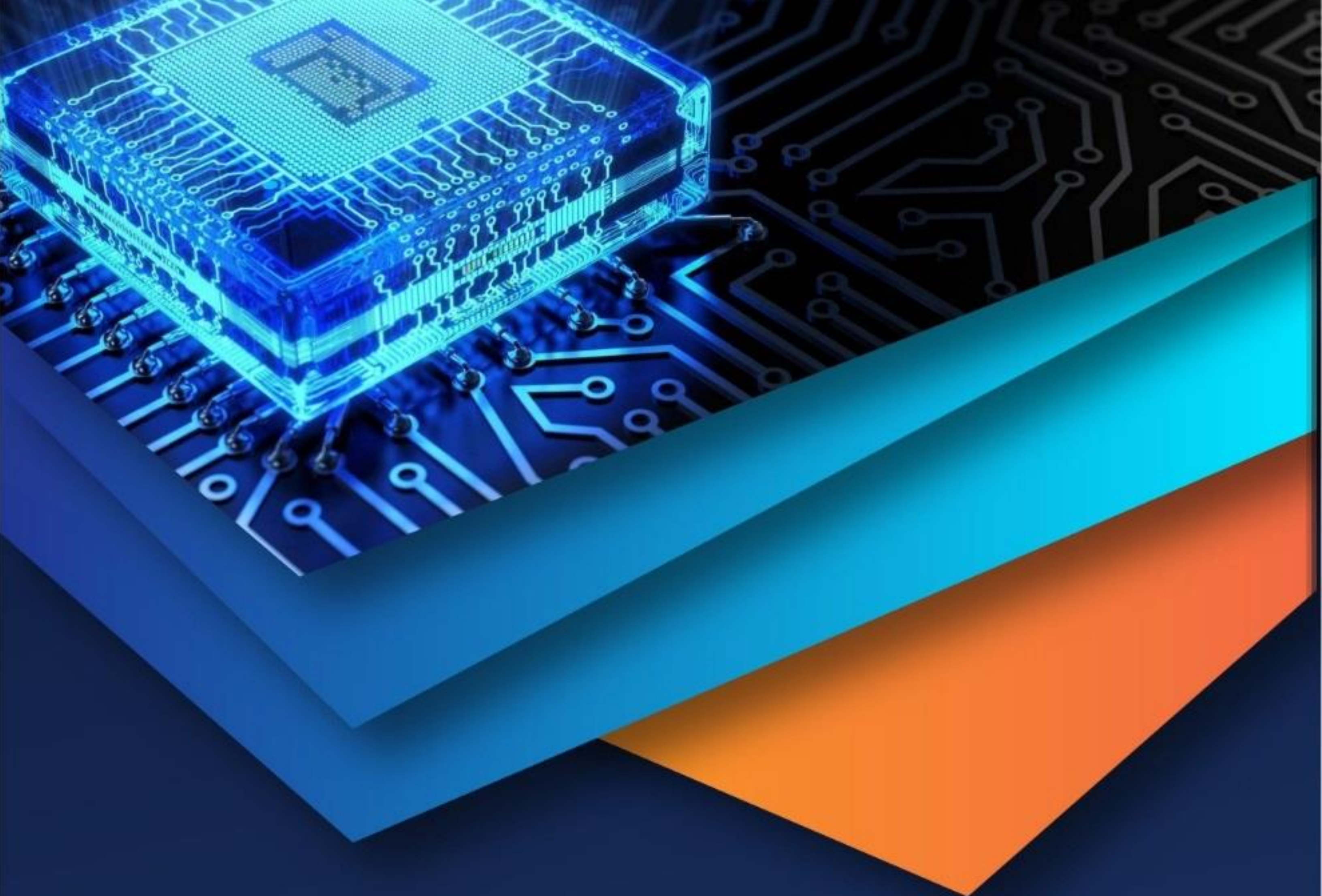


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