IDENTIFICATION OF BRAIN TUMOR ON MRI IMAGES WITH AND WITHOUT SEGMENTATION USING DL TECHNIQUES

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Abstract- Brain cancer is a critical disease that results in the deaths of many individuals. Early detection and classification of brain tumors is essential foreffective treatment and improved patient outcomes. However, current manual examination of MRI images for tumor detection can be time-consuming and imprecise. In this project, we propose a computer-based system that utilizes image processing techniques and convolutional neural networks (CNNs) for accurate and efficient brain tumor detection and classification. Our system involves several stages, including image pre-processing, segmentation, feature extraction, and classification. By training a CNN on a largedataset of MRI images with known tumor types, our system can accurately detect and classify brain tumors based on extracted features. The results of our experiments demonstrate the effectiveness of our systemin accurately detecting and classifying brain tumors, with potential to greatly improve the accuracy and speed of diagnosis, andultimately lead to improved patient outcomes. To explicitly depict the tumor region, we have also added the segmentationprocedure.

Keywords—MRI, Machine learning Deep learning, Pre-processing, Convolutional neural network

I INTRODUCTION

Detecting brain tumors is a crucial aspect of medical diagnosis, as these tumors can cause significant damage to the brain and potentially lead to death. Currently, the process of detecting brain tumors is donemanually by doctors through the examinationof MRI images.

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However, this approach can be time-consuming and imprecise, leading to inaccuracies in diagnosis and treatment.

To improve the accuracy and speed of brain tumor detection, researchers are exploring the use of computer-based systems that utilize image processing techniques and neural networks. Specifically, convolutional neural networks (CNNs) have shown promise in accurately detecting and classifying brain tumors based on MRI images.

The process of detecting brain tumors using image processing techniques involves several stages. First, the MRI images are pre- processed to improve their quality and reduce noise. Then, the images are segmented to isolate the tumor from the surrounding tissue. Feature extraction is then performed to extract relevant features from the segmented image, which can be used to train the CNN.

By training a CNN on a large dataset of MRI images with known tumor types, the system can learn to accurately classify new images based on extracted features. This technology has the potential to greatly improve the accuracy and speed of brain tumor detection and classification, which can lead to better treatment outcomes for patients with brain cancer.

LITERATUE SURVEY

[1] Dingwen Zhang et al., proposed a paper titled "Exploring Task Structure for Brain Tumor Segmentation From Multi-Modality MR Images"that was published in the year 2020 by 6th Institute of Electrical and Electronics Engineers(IEEE). This study, which attempts to enhance the tumor core region and segment the entire tumor area from input multi-modality bio-imaging data, has drawn significant interest from both academia and business. The current techniques, however, often handle this issue as a routine semantic segmentation work without considering the underlying guidelines in clinical practice. In actuality, doctors frequently identify various tumor sites by comparing volume data from several modalities. Additionally, they start by segmenting the most noticeable tumor location before progressively looking elsewhere for the other two. The first feature is referred to as the task-modality structures, whereas the task-task structure is the second feature. These two characteristics serve as the foundation for our novel task-structured brain tumor segmentation network (TSBTS net). In order to examine the task- modality structure, we specially develop a modality-aware feature embedding approach to infer the significant weights of the modality data network learning. We frame the prediction of the different tumor sites as conditional dependency sub-tasks and embed such dependence in the network stream in order to examine the task-during task structure.

[2] Mohammad Shahjahan Majib1 et al., proposed a paper titled "VGG Net-Based Deep Learning Framework for Brain Tumor Detection on MRI Images" that was published in the year 2021 by the Institute ofElectrical and Electronics Engineers(IEEE). This essay discusses brain tumors, a potentially deadly neurological condition caused by unregulated cell proliferation inside the skull or brain. This disease is making people die more often over time. Early diagnosis of malignant tumors is essential for effective treatment, and it also enhances the chance that the patient will live. The patient's likelihood of survival is frequently quite poor if they do not receive adequate treatment. A brain tumor will surely result in death if it is not discovered at an early stage. Therefore, the adoption of an automated technique is necessary for the early diagnosis of brain cancers. A major challenge is how to identify, diagnose, and isolate contaminated tumor regions from magnetic resonance (MR) images. Radiologists or other clinical professionals, however, must go through a difficult and lengthy procedure, and their performance is solely dependent on their degree of skill. The use of computer-assisted methods is necessary to get over these restrictions. In order to categorize the photos of brain tumors without requiring human interaction, many classic and hybrid ML models were

created and thoroughly examined in this work. In addition to this, 16 alternative transfer learning models were examined in order to decide which transfer learning model would be the most effective in classifying brain cancers using neural networks. A stacked classifier that beats all previous established models was finally suggested employing several cutting-edge technologies.

[3] MING LI 1 et al., proposed a paper titled"Brain Tumor Detection Based on Multimodal Information Fusion and Convolutional Neural Network" that was published in the year 2019 by the Institute ofElectrical and Electronics Engineers(IEEE). In this study, a combination of multimodal information fusion and convolution neural network detection approach of brain cancers, which we name a Multi-CNNs, are used to address the issue of poor accuracy of traditional brain tumor detection. First, this study extends 2D CNNs to multimodal 3D CNNs, allowing for the detection of brain lesions in several three-dimensional modalities. It can resolve the 2D-CNN's raw input, which calls for a significant neighborhood of errors, while also performing better at extracting the model of informational differences. In order to accelerate the network's convergence and address the overfitting issue, a true normalizing layer is then placed between the convolution layers and the pooling layer. In the end, the loss function was enhanced, and the lesion area's feature learning was enhanced by using the weighted loss function. The experimental findings demonstrated the applicability of the brain tumor detection approach suggested in this work to locate tumor lesions, with improved correlation coefficient, sensitivity, and specificity. The accuracy of the detection has greatly increased as compared to single mode and two-dimensional detection networks for brain tumors.

[4] Luxit Kapoor et al., proposed a paper titled "Survey on Brain Tumor Detection Using Image Processing Techniques" that was published in the year 2017 by the Institute of Electrical and Electronics Engineers(IEEE). The paper's main topic is biomedical image processing, a rapidly expanding and challenging industry. It includes a wide range of imaging techniques, including MRI, CT scans, and X-rays. These methods enable us to spot even the most minute physical anomalies in people. Medical imaging's main objective is to accurately and meaningfully extract information from pictures with the least amount of inaccuracy. Among the several medical imaging techniques at our disposal, MRI is the most dependable and secure. It doesn't entail subjecting the body to any hazardous radiation of any kind. The tumor can then be segmented after processing this MRI. Several alternative methods are used in tumor segmentation. Pre-processing, segmentation, optimization, and feature extraction are the four categories into which the entire process of identifying brain tumors from an MRI may be divided. This survey entails evaluating the research conducted by other experts and combining it into a single publication.

[5] Praveen Gamage et al., proposed a paper titled "Identification of Brain Tumor using Image Processing Techniques" that was published in the year 2017 by the Institute ofElectrical and Electronics Engineers(IEEE). The purpose of this study was to identify brain cancers using improved image segmentation algorithms on MRI scan pictures. This research also proposes a modified Probabilistic Neural Network (PNN) model to perform an automated brain tumor classification using MRI images. The model is based on learning vector quantization (LVQ) and uses image and data analysis and manipulation techniques. The training effectiveness, classification accuracies, and computing time are used to evaluate the improved PNN classifier's performance. The simulation findings demonstrated that when compared to image processing and published standard PNN methodologies, the modified PNN provides quick and accurate classification. The suggested system outperforms the similar PNN system given in [30], and when the spread value is equal to 1, it effectively handles the task of classifying brain tumors in MRI images with 100% accuracy. According to these findings, the proposed LVQ-based PNN system reduces processing time by around 79% when compared to the standard PNN,

making it extremely promising for the detection and diagnosis of in-vivo brain tumors.

EXISTING SYSTEM:

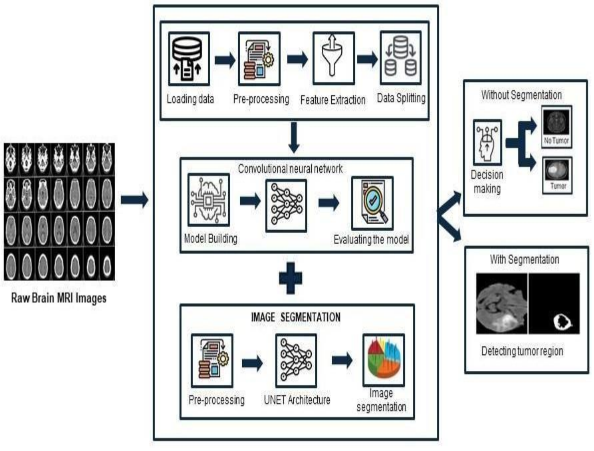
Currently, the most popular technique foridentifying and forecasting brain tumors is MRI scanning. In-depth images of the brain are produced by MRI using strong magnets and radio waves, which can detect tumors and other abnormalities.
Researchers in the disciplines of computer vision and machine learning have worked very hard over the past few decades to segment brain tumors automatically. Early researchers primarily employed hand-crafted features and shallow learning models, such as Conditional Random Field, Support Vector Machines , and Random Forests , to address this issue. Examples of these features includecontext feature , gradient feature , symmetry feature , and physical feature .

There are two sorts of DNN-based brain tumour segmentation techniques. The 2D CNN-based techniques fall under the firstcategory. These techniques divide the multi- modality 3D volume data into 2D patches or slices and process each 2D patch or sliceusing CNNs with a 2D convolutionoperation. For instance, Shaikh et al. suggested a 100-layer Tiramisu architecture to segment brain tumours from multi-modal MR slices. This design combines a densely linked fully convolutional neural network (FCNN) with a Dense Conditional Random Field (DCRF). To forecast the segmentation masks of each MR slice, Islam and Ren also extracted the hypercolumn features from FCNN.For 2D slice-based brain segmentation, Lopez and Ventura introducedthe dilation operation into the deep network.

PROPOSED SYSTEM:

The proposed technique for detecting brain tumors makes use of deep learning algorithms to analyze MRI data automatically and successfully identify tumors. Using image segmentation methods, the model also explicitly forecasts the tumor region. This method can greatly enhance diagnosis efficiency, consistency, and accuracy while lowering the possibility of human mistake and enhancing patient outcomes. This system can
also be expanded to manage vast amounts of medical imaging data and may even be implemented in real-time to facilitate quicker diagnosis and treatment. The proposed system's overall goal is to increase the speed and efficacy of diagnosing and treating brain tumors.

WORKING MODEL:



 https://doi.org/10.1051/e3sconf/202339904049

Fig 1. System Architecture

The initial phase of the process involves using an Artificial Neural Network Algorithm on MRI images of various patients to identify tumor blocks and determine the type of tumor present. The subsequent stage of the process employs several image processing techniques, including image segmentation, histogramequalization, image enhancement, morphological operations, and feature extraction, to detect brain tumors in MRI images of patients with cancer. The goal of thisresearch was to introduce an automated brain tumor detection method that would improve accuracy and reduce diagnosis time.

The first step of the system is Image Preprocessing, which involves removing noisefrom the input image by using a high pass filter.To segment the image, the system employs a simple region-based technique called Region growing, which involves selecting initial seed points. Morphological operations are utilized toextract boundary areas of the brain images, and basic operations such as Dilation and Erosion are employed for this purpose. Feature extraction is carried out to detect edges of the images and collect higher level information such as shape, texture, color, and contrast. Connected component labeling is used to assign a unique region label to each set ofconnected pixels having the same gray-level values. Finally, Tumor Identification is performed by extracting features from a previously collected dataset of brain MRIs andcomparing them with the knowledge base.

	METHODOLOGY	ACCURACY	FEATURES	DATASET
EXISTING SYSTEM	ANN	87%	Feature Extraction	CT Scan(Brain tumor)
PROPOSED SYSTEM	Deep CNNmodels	96%	Deep feature extraction and classification	MRI Scans(Brain tumor)

Table 1. Comparison of existing model's withthe proposed model

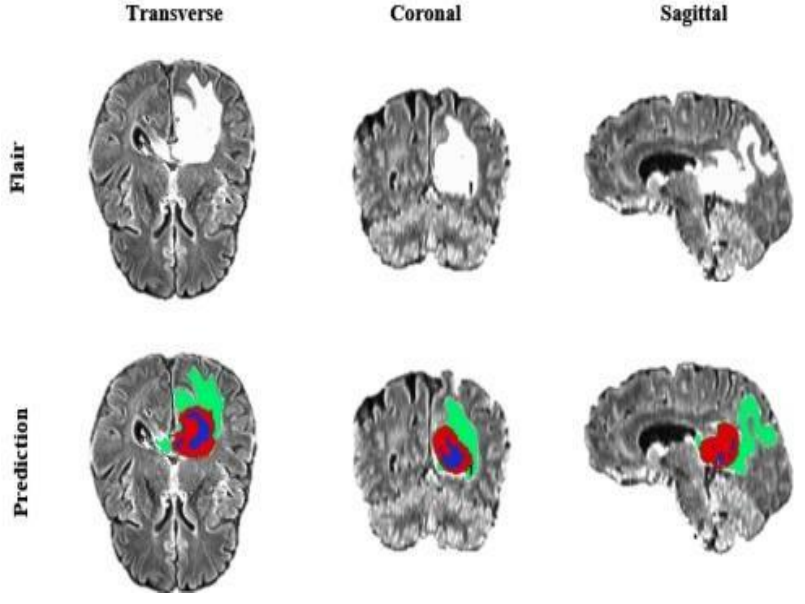


Fig 2. Transverse, coronal, and sagittal slicesfrom an example MRI Flair scan.

CONCLUSION

We have researched existing feature-based research in the field of brain tumor identification. In featurebased, we have examined image pre-processing, segmentation, features extraction, and classification algorithms. Additionally, research CNN's deep learning algorithms. This system determines if a tumor is there or not; if a tumor is present, the model responds with a positive answer; otherwise, it responds with a negative one. It locates the tumor area if a tumor is found.
However, not every work in the development industry is considered faultless, and this application may still be improved upon. I have picked up a lot of knowledge about the topic of development and learnt a lot of new things.

FUTURE ENHANCEMENT

There is potential for further improvement inthe accuracy of the model with the inclusion of more diverse data and fine-tuning of the hyper-parameters. Integration with other medical imaging technologies and data analysis tools can be explored to enhance thecapabilities of the system. Additionally, the system can be expanded to include automatedsegmentation and classification of tumors based on their characteristics.

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