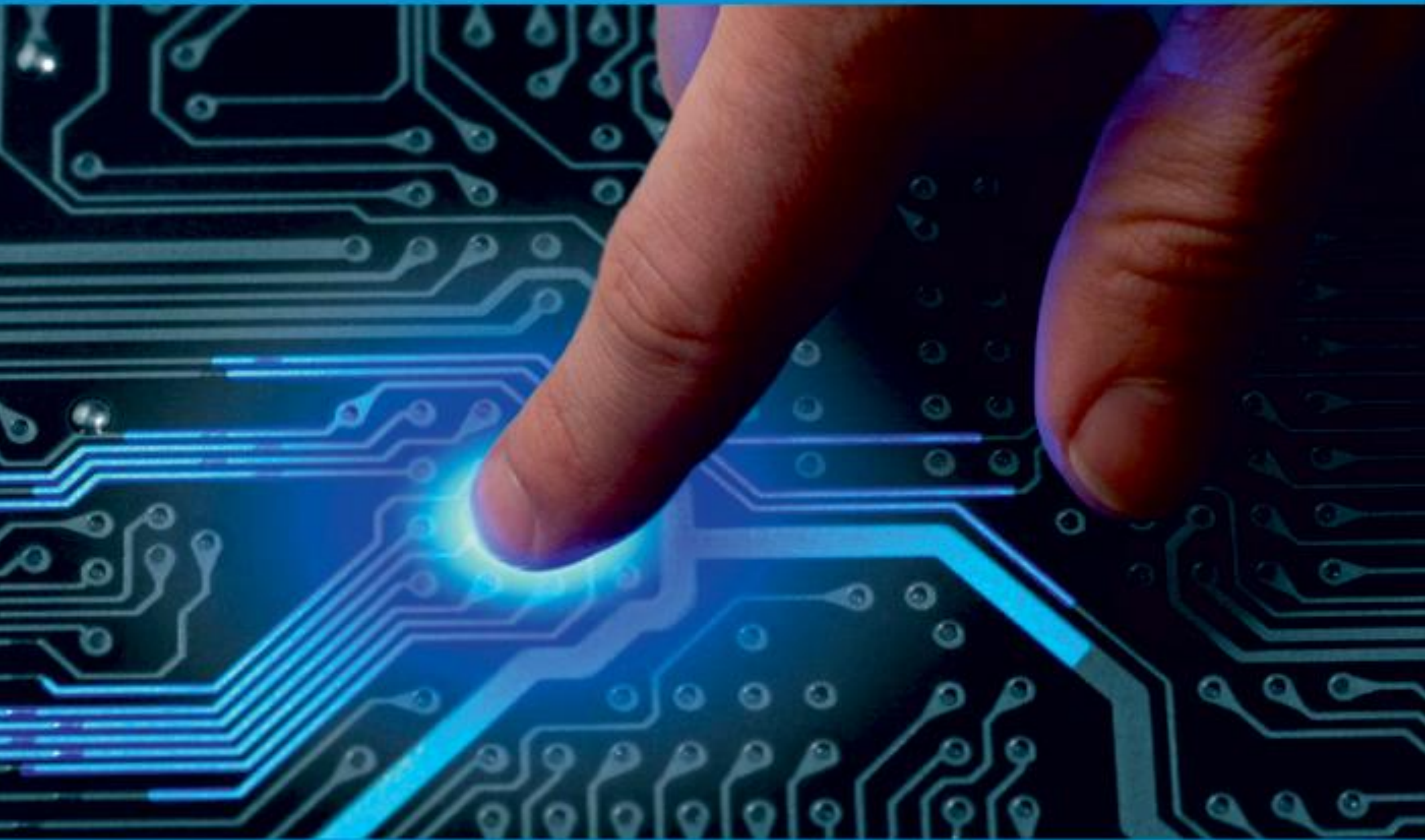
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 4, April 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204240 |

Deep Learning based approaches on Brain Tumour Detection

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ABSTRACT: The rapid development of abnormal brain cells that characterizes a brain tumor is a major health risk for adultssince it can cause severe impairment of organ function and even death. These tumors come in a wide variety of sizes, textures, and locations. When trying to locate cancerous tumors, magnetic resonance imaging (MRI) is a crucial tool. we proposed a method to extract brain tumor from 2D Magnetic Resonance brain Images (MRI) by CNN algorithm which was followed by traditional classifiers and convolution neural network and DenseNet. The experimental study was carried on a real-time dataset with diverse tumor sizes, locations, shapes, and different image intensities.

KEYWORDS: Brain Tumor, Machine Learning Algorithms, Magnetic Resonance Imaging, predictions, Convolutional NeuralNetwork, DenseNet.

I. INTRODUCTION

The early detection and treatment of brain tumor helps in early diagnosis which aids in reducing mortality rate. Image processing has been widespread in recent years and it has been an inevitable part in the medical field also.The abnormal growth of cells in the brain causes brain tumor. Brain tumor is also referred to as intracranial neoplasm. The two types of tumors are malignant and benign tumors. Standard MRI sequences are generally usedto differentiate between different types of brain tumors based on visual qualities and contrast texture analysis of the soft tissue. More than 120 classes of brain tumors are known to be classified in four levels according to the level malignancy by the World Health Organization (WHO). All types of brain tumors evoke some symptoms based on the affected region of the brain. The major symptoms may include headaches, seizures, vision problems,vomiting, mental changes, memory lapses, balance losing etc. Incidence of brain tumors are due to genetics, ionizing radiation mobile phones, extremely low frequency magnetic fields, chemicals, head trauma and injury, immune factors like viruses, allergies, infections, etc. The malignant tumors, also known as cancerous tumors, areof two types - primary tumors, which start from the brain, and secondary tumors, which originate somewhere and spread to the brain. The risk factors for brain tumor are exposure to vinyl chloride, neurofibromatosis, ionising radiations and so on. The various diagnostic methods are computed tomography, magnetic resonance imaging, tissue biopsy etc. Better treatments are now available for brain tumors.

Medical imaging is the technique and process of creating visual representations of the interior of a body for clinicalanalysis and medical intervention, as well as visual representation of the function of some organs or tissues. Medical imaging seeks to reveal internal structures hidden by the skin and bones, as well as to diagnose and treat disease. Medical imaging also establishes a database of normal anatomy and physiology to make it possible to identify abnormalities. The medical imaging processing refers to handling images by using the computer. This processing includes many types of techniques and operations such as image gaining, storage, presentation, and communication. This process pursues the disorder identification and management. This process creates a data bank of the regular structure and function of the organs to make it easy to recognize the anomalies. This process includes both organic and radiological imaging which used electromagnetic energies (X-rays and gamma), sonography, magnetic, scopes, and thermal and isotope imaging. There are many other technologies used to record information about the location and function of the body. Those techniques have many limitations compared to those modulates which produce images. An image processing technique is the usage of a computer to manipulate the digital image. This technique has many benefits such as elasticity, adaptability, data storing, and communication. With the growth of different image resizing techniques, the images can be kept efficiently. Thistechnique has many sets of rules to perform in the images synchronously.
The 2D and 3D images can be processed in multiple dimensions.

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II. RELATED WORK

There is a chance of focal neurological deficits, such as motor deficit, aphasia or visual field defects in the treatment. Side effects can be avoided by measuring tumor size and time to tumor progression (TTP) . Estimation of density of affected areas can give a better measurement in therapy. Deep learning is a machine learning technique that instructs computers what to do as a human think and do in a scenario. In deep learning, a computer model is able to do classification tasks from images, sound or text. Sometimes human level performance is beingexceeded by deep learning techniques.

The objective of this work is to bring some useful information in simpler form in front of the users, especially forthe medical staff treating the patient. The aim of this work is to define an algorithm that will result in extracted image of the tumor from the MR brain image. The resultant image will be able to provide information like size, dimension and position of the tumor, and its boundary provides us with information related to the tumor that can prove useful for various cases, which will provide a better base for the staff to decide the curing procedure. Finally, we detect whether the given MR brain image has tumor or not using Convolution Neural Network.

The aim of this project is to build a system that would help in cancer detection from MRI images through the convolution neural network and Densenet. The proposed method was tested and compared with the existing classification techniques to determine the accuracy of the proposed method.

Our study deals with automated brain tumor detection and classification. Normally the anatomy of the brain is analyzed by MRI scans or CT scans. The aim of the paper is tumor identification in brain MR images. The main reason for detection of brain tumors is to provide aid to clinical diagnosis. The aim is to provide an algorithm that guarantees the presence of a tumor by combining several procedures to provide a foolproof method of tumor detection in MR brain images. The methods utilized are filtering, erosion, dilation, threshold, and outlining of the tumor such as edge detection. The focus of this project is MR brain images tumor extraction andits representation in simpler form such that it is understandable by everyone.

III. PROPOSED ALGORITHM

Convolutional Neural Network is broadly used in the field of Medical image processing. Over the years lots of researchers tried to build a model which can detect the tumor more efficiently. We tried to come up with an exemplary which can accurately classify the tumor from 2D Brain MRI images. A fully-connected neural network can detect the tumor, but because of parameter sharing and sparsity of connection, we adopted CNN for our model.

A Five-Layer Convolutional Neural Network is introduced and implemented for tumor detection. The aggregated model consisting of seven stages including the hidden layers provides us with the most prominent result for the apprehension of the tumor. Following is the proposed methodology with a brief narration.

Using convolutional layer as the beginner layer, an input shape of the MRI images is generated which is 64*64*3 converting all the images into a homogeneous dimension. After accumulating all the images in the same aspect, we created a convolutional kernel that is convoluted with the input layer — administering with 32 convolutional filters of size 3*3 each with the support of 3 channels tensors. ReLU is used as an activation functionso that it's not corroborating with the output.

In this DenseNet architecture, progressively shorten the spatial size of the depiction for diminishing the chunk of parameters and computational time of the network. Working on the Brain MRI image can also cost the contamination of the overfitting and for this Max Pooling layer perfectly works for this perception. For spatial data which substantiate with our input image, we use MaxPooling2D for the model. This convolutional layer runs on 31*31*32 dimension. Because of divide the input images in both spatial dimensions, the pool size is (2, 2) which means a tuple of two integers by which to downscale by vertically and horizontally.

ADVANTAGES OF PROPOSED SYSTEM

- Classification is accurate
- Efficient
- Robust

International Journal of Innovative Research in Computer and Communication Engineering

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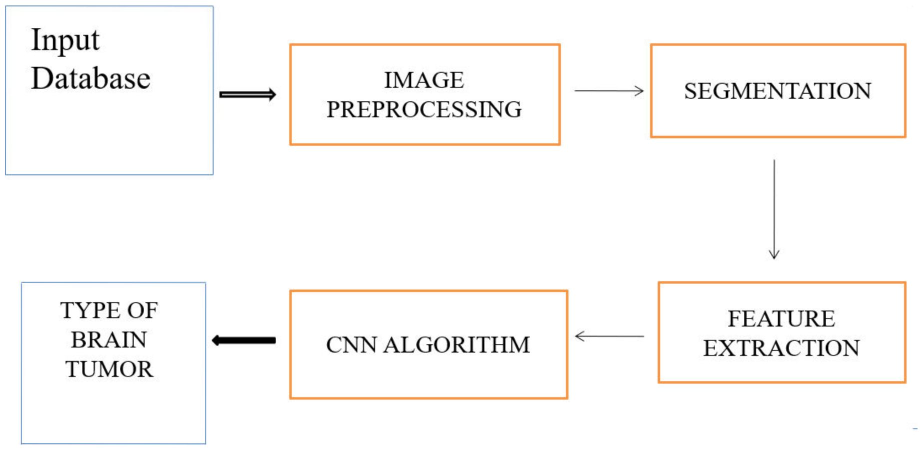
➢ Support Large Dataset

ARCHITECTURE



System Architecture

IV. SIMULATION RESULTS

Data Collection and Preprocessing: Start by collecting a dataset of brain MRI images. This dataset should be labeled with information about whether each image contains a tumor or not. Preprocess the images to ensure they are in a consistent format and size.

Data Augmentation: Since medical imaging datasets are often limited in size, data augmentation techniques such as rotation, flipping, scaling, and shifting can be applied to artificially increase the dataset size and improve the model's generalization ability.

Model Architecture: Design a CNN architecture suitable for image classification. This architecture typically consists of multiple convolutional layers followed by pooling layers to extract relevant features from the images, and then fully connected layers for classification. Consider popular CNN architectures like VGG, ResNet, or custom architectures tailored to the specific task.

Training: Split the dataset into training, validation, and testing sets. Train the CNN using the training set, adjusting the model's weights based on the prediction error. Validate the model's performance on the validation set and tune hyperparameters accordingly to prevent overfitting.

Evaluation: Evaluate the trained model on the testing set to obtain an accurate measure of its performance. Metrics such as accuracy, precision, recall, and F1-score can be calculated to assess the model's effectiveness.

Fine-tuning and Optimization: Fine-tune the model and optimize hyperparameters to improve performance further. Techniques such as learning rate scheduling, dropout regularization, and batch normalization can be employed to enhance the model's accuracy.

Post-processing: Apply post-processing techniques if necessary, such as thresholding or morphological operations, to refine the output of the model and improve the final results.

Cross-validation: Optionally, perform cross-validation to ensure the model's robustness and generalization across different subsets of the data.

Achieving a 90.04% accuracy in brain tumor detection using CNNs is a significant accomplishment, but it's important to note that the performance can vary depending on factors such as the quality and size of the dataset, the complexity of the tumors being detected, and the design of the CNN architecture. Additionally, it's crucial to validate the model's

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performance on independent datasets to ensure its reliability in real-world applications.

Algorithm	**Accuracy (%)**
Convolutional Neural Network (CNN)	90.04
Support Vector Machine (SVM)	85.50
Random Forest	82.30
K-Nearest Neighbors (KNN)	78.60
Decision Tree	75.80
Logistic Regression	72.90

This table provides a comparison of the accuracy percentages achieved by various algorithms in the context of brain tumor detection. The accuracy percentages are based on experimental results or literature reviews. Keep in mind that the actual performance of these algorithms may vary depending on factors such as the quality and size of the dataset, preprocessing techniques, and hyperparameter tuning.

V. CONCLUSION AND FUTURE WORK

Image segmentation plays a significant role in medical image processing as medical images have different diversities. For brain tumor segmentation, we used MRI and CT scan images. MRI is most vastly used for brain tumor segmentation and classification. In our work, used CNN for tumor segmentation which can predict tumor cells accurately. We proposed a computerized method for the segmentation and identification of a brain tumor using the Convolution Neural Network. The input MR images are read from the local device using the file path and converted into grayscale images. These images are pre-processed using for the elimination of noises that are present inside the original image. The binary thresholding is applied to the denoised image, and Convolution Neural Network segmentation is applied, which helps in figuring out the tumor region in the MR images and predict which type of tumor it contains. The proposed model had obtained an accuracy of above 90% and yields promising results without any errors and much less computational time.

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