VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI-590018, KARNATAKA.

A PROJECT REPORT

On

"IDENTIFICATION AND CLASSIFICATION OF BRAIN TUMOR"

Submitted in Partial Fulfillment for the Award of the Degree
of

BACHELOR OF ENGINEERING
IN
COMPUTER SCIENCE & ENGINEERING

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Certificate

Certified that the Project Work entitled **"IDENTIFICATION AND CLASSIFICATION OF BRAIN TUMOR"** carried out by MANISHA L (1SG18CS047), bonafide student of Sapthagiri College of Engineering, in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering of Visvesvaraya Technological University, Belagavi** during the academic year 2021-2022. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the Department Library. The project report has been approved as it satisfies the academic requirements in respect of **Project Work Phase II (18CSP83)** prescribed for the said degree.

21/07/2022		
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ABSTRACT

A brain tumor is a disease caused due to the growth of abnormal cells in the brain. There are two main categories of brain tumor, they are non-cancerous (benign) brain tumor and cancerous(malignant) brain tumor. Survival rate of a tumor prone patient is difficult to predict because brain tumor is uncommon and are different types. Treatment for brain tumor depends on various factors like: the type of tumor, how abnormal the cells are and where it is in the brain etc. With the growth of Artificial Intelligence, Deep learning models are used to diagnose the brain tumor by taking the images of magnetic resonance imaging (MRI). This project detects whether the brain tumor is present or not from MRI scans. It uses the CNN classification technique which is used to classify the type of brain tumor present. If the detected tumor is non-cancerous(benign), the further classification of the type of tumor is done. The implementation of the suggested model is applied in the Python and TensorFlow environment. Algorithms and methodologies used to solve specific research problems are included in the results and along with their strengths and limitations. This examines the quantitative characteristics of brain tumors, such as shape, texture, and signal intensity, to predict high accuracy with a low error rate.

CHAPTER 1

INTRODUCTION

1.1 BRIEF INTRODUCTION

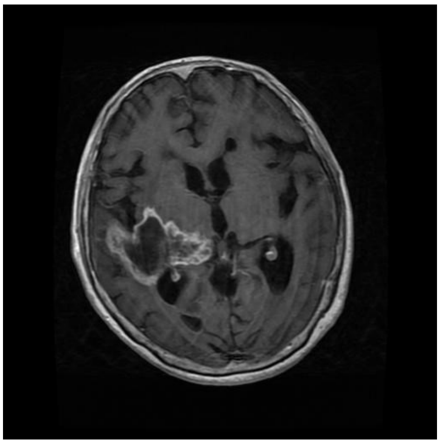
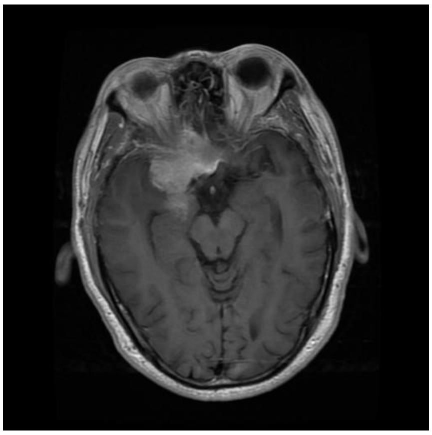
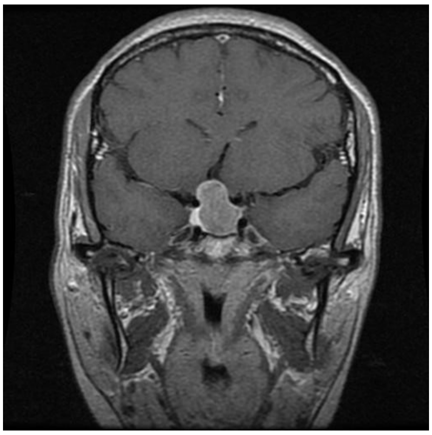
The human brain, a marvel of complexity with billions of cells orchestrating myriad functions every second, becomes vulnerable when subjected to damage. The manifestation of abnormal tissue development within the brain, impeding its optimal functionality, is identified as a brain tumor. Recognizing the imperative need for enhanced outcomes in medical scenarios, computer assistance has made significant strides in therapeutic organizations. While the cost of traditional two-dimensional MRI readings remains high, there is a burgeoning interest in the development of sophisticated software to aid clinical practitioners. Human observers traditionally delineate tumor features, but to augment accuracy, a mechanized diagnostic framework incorporating specific anatomical features has been implemented. The existing framework has been further refined through the introduction of a diagnostic system to elevate precision. The inefficiencies associated with manual segmentation, including time consumption and reduced accuracy leading to inter and intra-rater errors, have prompted the need for automated segmentation. Automated segmentation becomes crucial as it provides information about the surrounding tissues adjacent to the tumor, addressing the intensity variations within similar groupings. The utilization of MRI segmentation in treatment monitoring has gained prominence, especially with advancements in image-guided surgical methodologies. A pivotal step in this process involves outlining tumor contours, and this method relies on Convolutional Neural Networks (CNN) to learn specific features crucial for gliomas detection and segmentation. This integration of advanced technology marks a significant stride in improving the accuracy and efficiency of brain tumor diagnosis and treatment.

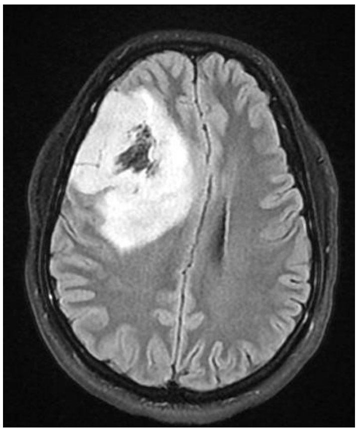
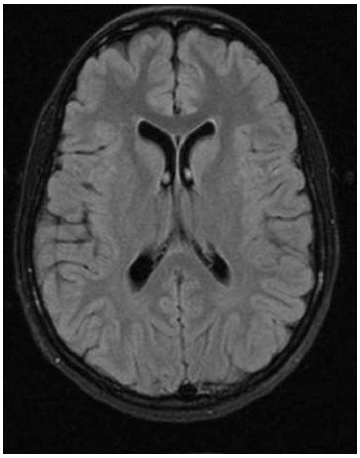
The field of medical imaging has witnessed transformative advancements with the integration of artificial intelligence, particularly the application of Convolutional Neural Networks (CNNs). In the context of brain tumor classification and identification, CNNs have emerged as a powerful tool, revolutionizing the accuracy and efficiency of diagnostics. This innovative approach leverages the ability of CNNs to autonomously learn intricate patterns and features from magnetic resonance imaging (MRI) scans, offering a sophisticated solution to the challenges posed by brain tumors.

1.1.1 Brain Tumor Classification:

Brain tumors, characterized by the abnormal growth of cells in the brain, present a diverse array of types, ranging from benign to malignant. Accurate and timely classification of these tumors is paramount for effective treatment planning and patient outcomes. Traditional methods of classification often rely on manual examination, which can be time-consuming and subject to human error. The advent of CNNs introduces a paradigm shift, enabling automated and precise classification based on learned features extracted from MRI images.

Table 1.1 Classification of brain tumors based MRI scans

Name of the tumor	MRI scan image	Description	Location
Glioma Tumor		Glioma is a type of tumor that occurs in the brain and spinal cord. Gliomas begin in the gluey supportive cells (glial cells) that surround nerve cells and help them function.	Glial cells (surrounding nerve cells)
Meningioma Tumor		A meningioma is a tumor that arises from the meninges — the membranes that surround your brain and spinal cord.	Meninges (membranes in the brain)
Pituitary Tumor		Pituitary tumors originate in the pituitary, a pea-sized gland in the brain that secretes and regulates hormones controlling many important body functions.	Pituitary gland and brain

Glioblastoma Multiforme Tumor		Glioblastoma multiforme (GBM) is a fast-growing glioma that develops from star-shaped glial cells that support the health of the nerve cells within the brain.	Astrocytes and Oligodendrocytes
Oligodendroglioma Tumor		Oligodendroglioma is a rare brain tumor that begin in a certain type of glial cells. Glial cells are glue-like cells that surround nerve cells and help them function.	Frontal and temporal lobes of the brain
No Tumor		No description	No description

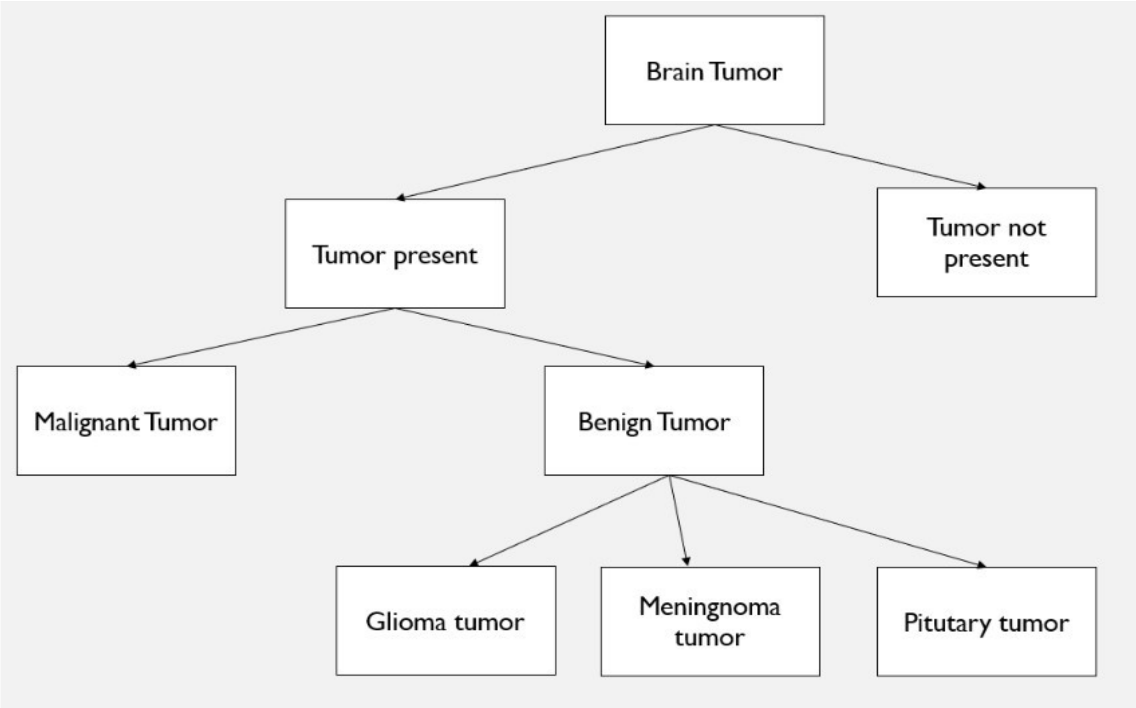


Fig 1.2 Classification done in the proposed system

ADVANTAGES:

- The proposed project eliminates the need for BIOPSY which is a risky medical procedure required to detect the type of brain tumor.
- Early and accurate diagnosis of type of brain tumor.
- The classification of non-cancerous brain tumor such as Glioma, Meningioma, Pituitary tumors.
- This project provides a low-cost solution for the diagnosis of brain tumor.

1.1.2. Identification Using CNN:

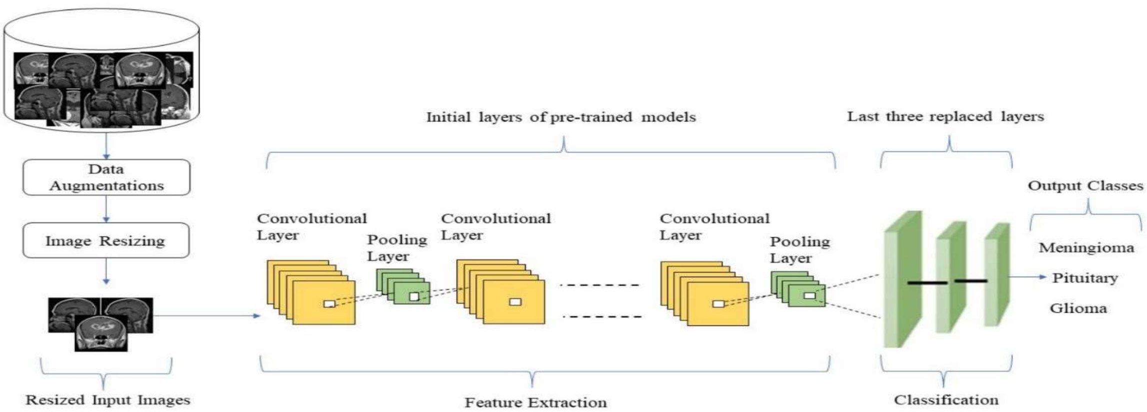


Fig 1.1 Overview of the proposed method for brain tumor classification

Convolutional Neural Networks are particularly well-suited for image analysis tasks. In the context of brain tumor identification, CNNs excel at discerning subtle patterns, textures, and spatial relationships within the MRI scans that may indicate the presence of a tumor. The hierarchical architecture of CNNs allows them to automatically extract relevant features, capturing both global and local characteristics crucial for accurate diagnosis.

Key Components of CNN-based Identification:

1. Convolutional Layers:These layers apply filters to the input MRI images, capturing essential features such as edges, shapes, and textures.

2. Pooling Layers:Pooling layers reduce the spatial dimensions of the feature maps, retaining critical information and enhancing computational efficiency.

3. Fully Connected Layers: These layers leverage the learned features to make predictions about the presence and type of brain tumor.

Benefits of CNN in Brain Tumor Identification:

- Accuracy: CNNs have demonstrated remarkable accuracy in distinguishing between various types of brain tumors, outperforming traditional methods.
- Efficiency: Automated identification reduces the time required for diagnosis, enabling quicker treatment initiation.
- Consistency:CNNs provide consistent results, minimizing variability associated with human interpretation.

In this era of technological integration in healthcare, the application of CNNs for brain tumor classification and identification marks a significant stride towards precision medicine. This innovative approach not only enhances diagnostic capabilities but also holds the potential to improve patient outcomes through timely and accurate interventions. The subsequent sections delve into the methodologies, results, and implications of utilizing CNNs in the intricate landscape of brain tumor diagnostics.

CHAPTER 7

CONCLUSION AND FUTURE WORKS

CONCLUSION

Brain tumors are relatively rare compared, that is, 1.4% of new cases per year, in developed countries. Deaths from brain tumors have increased in the last few decades. Therefore, the scope of this project is expanded. Brain tumors, especially those that are harmful, are considered to be incurable and deadly. The need for early detection stems from the fact that brain tumors may have invisible and frightening symptoms at first. To identify the type of tumor in the brain, a dangerous medical procedure was performed and a biopsy was performed. This project proposes a way to detect and diagnose the type of brain tumor that is based on MRI (Magnetic Resonance Imaging) of a patient-fed scan of the system. It also provides an accurate diagnosis of existing brain tumors based on CNN classification algorithm. Biopsy can be greatly avoided due to the precise discharge of the system. This is considered to be the least expensive way to solve a brain tumor problem. Previous systems have used various algorithms and methods to prove the existence of a brain tumor by machine learning. This system provides a clear picture of the precise tumor present in the patient by considering various factors such as location, size etc. This method proves to be an accurate and effective method of diagnosing a brain tumor problem.

FUTURE SCOPE

Build an app-based user interface in hospitals which allows doctors to easily determine the impact of tumor and suggest treatment accordingly Since performance and complexity of ConvNets depend on the input data representation we can try to predict the location as well as stage of the tumor from Volume based 3D images.

By creating three dimensional (3D) anatomical models from individual patients, training, planning and computer guidance during surgery is improved. Using VolumeNet with LOPO (LeaveOne-Patient-Out) scheme has proved to give a high training as well as validation accuracy(>95%).In LOPO test scheme, in each iteration, one patient is used for testing and remaining patients are used for training the ConvNets, this iterates for each patient.

Although LOPO test scheme is computationally expensive, using this we can have more training data which is required for ConvNets training. LOPO testing is robust and most applicable to our application, where we get test result for each individual patient.

So, if classifier misclassifies a patient, then we can further investigate it separately. Improve testing accuracy and computation time by using classifier boosting techniques like using more number images with more data augmentation, fine-tuning hyper parameters, training for a longer time i.e. using more epochs, adding more appropriate layers etc.. Classifier boosting is done by building a model from the training data then creating a second model that attempts to correct the errors from the first model for faster prognosis. Such techniques can be used to raise the accuracy even higher and reach a level that will allow this tool to be a significant asset to any medical facility dealing with brain tumors. For more complex datasets, we can use U-Net architecture rather than CNN where the max pooling layers are just replaced by up sampling ones. Ultimately we would like to use very large and deep convolutional nets on video sequences where the temporal structure provides very helpful information that is missing or far less obvious in static images. Unsupervised transfer learning may attract more and more attention in the future.

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