A Project Report On

Brain Tumor Detection

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Department- CSE, Semester- 7th
Subject: Project-II (PROJ- CS781)

Under the guidance of Prof. Uday Kumar Mandal

A Project Report
To be submitted in the partial fulfillment of the requirements
For the degree of
Bachelor of Technology in Computer Science and Engineering

Department of Computer Science and Engineering,
Academy of Technology

Affiliated to

Maulana Abul Kalam Azad University of Technology, West Bengal

2022

CERTIFICATE

This is to certify that the project entitled: Brain Tumor Detection submitted to MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY in the partial fulfillment of the requirement for the award of the B.TECH degree in COMPUTER SCIENCE AND ENGINEERING of Project-II (PROJ- CS781) is carried out by

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under my guidance. The matter embodied in this project is genuine work done by the students and has not been submitted whether to this University or to any other University/Institute for the fulfillment of the requirement of any course of study.

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We hereby state that the Project Report entitled Brain Tumor Detection has been prepared by us to fulfill the requirements of Project-II (PROJ- CS781) during the period August 2022 to November 2022.

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Signature of the students

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Abstract

A tumor is an uncontrolled growth of tissues in any part of the body. Tumors are of different types and characteristics and have different treatments. Brain tumors are the most known and aggressive disorder, leading to a poor lifetime at the highest level. Treatment is one of the main benefits of development that saves a life. Magnetic resonance imaging (MRI) is the imaging technique used to diagnose brain tumor disease. Early diagnosis of brain tumors is an essential task in medical work to find out whether the tumor can potentially become cancerous. Deep learning is a handy and efficient method for image classification. Deep learning has been widely applied in various fields including medical imaging, because its application does not require the reliability of an expert in the related field, but requires the amount of data and diverse data to produce good classification results. Convolutional Neural Network (CNN) is the deep learning technique to perform image classification. CNN is able to extract features without removing the spatial information from the input data. CNN is a machine learning method to process two-dimensional data.

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INTRODUCTION

Chapter 1

Intoduction

Brain tumor, occurs when abnormal cells form within the brain. There are two main types of tumors: malignant or cancerous tumors and benign tumors. Malignant tumor involves abnormal cell growth with the potential to invade or spread to other parts of the body. Benign tumors do not spread to other parts of the body. Fig. 1 shows the presence of tumor in human brain.

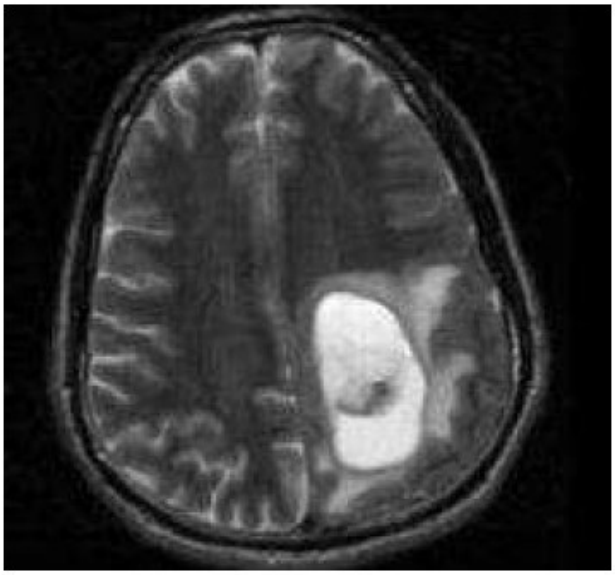

Fig 1: MRI Of Human Brain. Note:- The presence of a Tumor Towards the Bottom Left

Normally brain tumor affects CSF (Cerebral Spinal Fluid). It causes strokes. The physician gives the treatment for the strokes rather than the treatment for tumor. So detection of tumor is important for that treatment. Medical imaging techniques play an important role in diagnosis and early detection of tumor. MRI, computed tomography (CT), digital mammography, and other imaging processes give an efficient means for detecting different types of diseases. Manually delineating brain tumor sub-regions from MRI scans is a subjective task, and therefore it is time-consuming and prone to variability. Automated segmentation of gliomas from multimodal MRI images can consequently assist the physicians to speed-up diagnosis and surgical planning as well as provide an accurate, reproducible solution for further tumor analysis and monitoring. Unsupervised learning algorithms bypass the complexity in designing and selecting features by automatically learning a hierarchy of feature representations, with deep learning models excelling at the task. Convolutional Neural Networks (CNNs) is regarded as the state of the art methods for brain tumor image segmentation as they learn the most useful and relevant features automatically.

CHAPTER 2

LITERATURE OVERVIEW

Chapter 2

Literature Overview

Image segmentation has entailed the division or separation of the image into regions of similar features. The definitive aim in image processing applications is to extract important attributes from the image data, from which the machine can obtain a descriptive, interpretative, or understandable prospect. Several pieces of literature are available in this field of study. Jianping Fan et al. [1] paper presents an automatic image segmentation method using the thresholding technique. This is based on the assumption that adjacent pixels whose value(grey level, color value, texture, etc) lies within a certain range belong to the same class and thus, good segmentation of images that include only two opposite components can be obtained. Jaskirat Kaur et al. Paper presented thresholding and edge detection as being the important aspects of image segmentation that comes before feature extraction and image recognition system for analyzing images. It helps in extracting the basic shape of an image, overlooking the minute unnecessary details. In this paper using image segmentation (thresholding and edge detection) techniques different geo-satellite images, and medical and architectural images are analyzed. To quantify the consistency of our results error measure is used [2]. Mohd Fauzi Bin Othman et al. in 2011, performed the classification of brain tumors using a wavelet-based feature extraction method and Support Vector Machine (SVM). Feature extraction was carried out using Daubechies (db4) wavelet, and MR brain images' approximation coefficients were used as feature vectors for classification. An accuracy of only 65% was obtained, where, only 39 images were successfully classified from 60 images. It was concluded that classification using SVM resulted in limited precision since it cannot work accurately for large data due to training complexity. Nagesh Subbanna et al. proposed a fully automated segmentation system [3] in which an initial Bayesian tumor classification based on Gabor texture features permits subsequent computations to be focused on areas where the probability of tumor is deemed high. An iterative, multistage Markov Random Field (MRF) framework is then devised to classify the various tumor subclasses. Andac Hamamci et al. in their paper [4] a cellular automata (CA) based seeded tumor segmentation method on contrast-enhanced T1 weighted MRI, which standardizes the volume of interest (VOI) and seed selection, is proposed. S.M. Ali, Loay Kadom Abood, and Rabab Saadoon Abdoon proposed a method in which Gray level stretching and Sobel edge detection, K-Means Clustering technique based on location and intensity. Fuzzy C-Means Clustering, and An Adapted K-Means clustering technique and Fuzzy C Means technique with morphological operations have been applied to extract the tumour region [5].

Chapter 3

Problem definition & Objectives

Chapter 3

Problem Definition & Objectives

Problem Definition: In this work we build a Brain Tumor Detection Model Using convolutional neural network. The MRI Images are taken as a input dataset. then the processing of the images are to be done. In there both tumor affected and not affected images are present. By using convolutional neural network we try to detect the Tumor affected images. Using the algorithm we train the model. Using data augmentation we increase the size of the images. After that the model can automatically detect the tumor affected images with high accuracy.

Objective: Early detection of brain tumors has got a very important role in the treatment and cure. Brain tumor detection is a tedious job because of the complex structure of the brain. From the MR Images, information such as tumor location can be understood. It provides an easier way to diagnose the tumor and plan the surgical approach for its removal. Doctors don't have methods that can be used for brain tumor detection and standardization which leads to varying conclusions from one doctor to another. There comes the requirement of an automated system. For locating tumors in magnetic resonance image (MRI) segmentation of MRI plays an important role. The existing classification methods have limitations in accuracy, and exactness and require manual interactions.

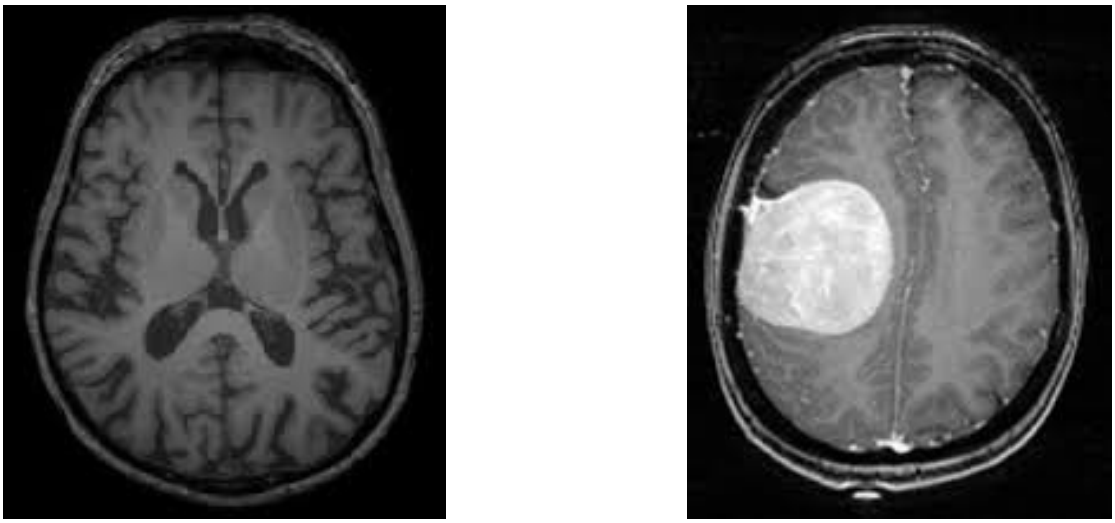

Figure 3: Brain without a tumor (left) Brain with a tumor(right)

Chapter 4

Feasibility Study

Chapter 4

Feasibility Study

In this project we are going to create an Machine learning model that will detecting brain tumors automatically from MRI images of brain .

Market feasibility: Detection of brain tumors are done manually by doctors. Doctors go through the MRI image of a brain to check whether it has tumors or not .Our model will be used to do it. In this project we are planning to provide a solution to do it automatically . It will help our health sectors to work faster. It will be very much useful when the patient needs for immediate response from doctors . It may be a life saver for many of the patients.

Technical Feasibility: In this proposed model we are going to use CNN .And we will be implementing it using python programming language. And the dataset we are going to use will be downloaded from https://www.kaggle.com/datasets/navoneel/brain-mri-images-for-brain-tumor-detection. In case of technical requirements we will be needing a notebook where we can edit our python code for example Jupyter Notebook, Pycharm or VScode . We will be using various inbuilt libraries .Numpy ,Pandas , Keras , TensorFlow , Matplotlib , OpenCV. We will be using python version 3.x to build the model.

Chapter 5

Proposed Scheme

Chapter 5

System Analysis/Proposed Scheme

The proposed scheme is to build a Machine Learning model that will be detecting whether there is a brain tumor or not from an MRI image of a human brain. The motive is to train the CNN based Machine Learning Model through MRI images.

Dataset:- The Dataset is supposed to have around 200 MRI images of brain. The images are labeled as YES if there is a tumor in brain and NO if there is not a tumor in the brain. The images are taken in .jpg
format.

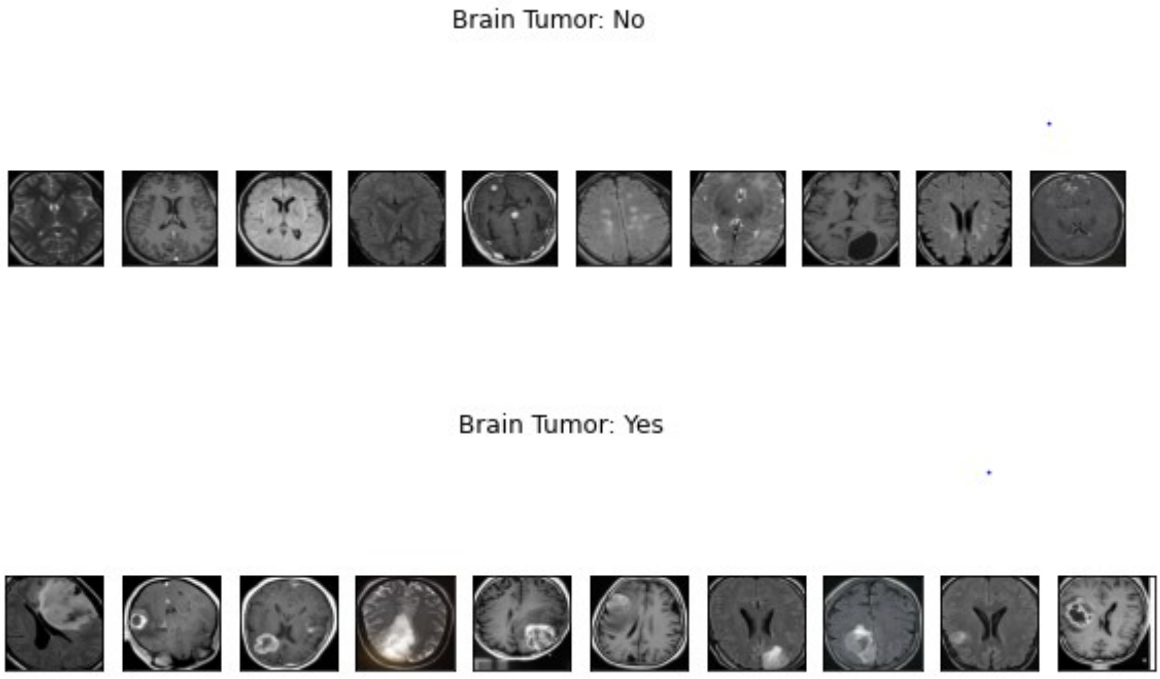

Figure 5.1: Sample dataset

Chapter 5

- **Proposed Method:** This model will use CNN for automatic detection of brain tumors. The study uses input images labeled as Yes/No to build the classifier that will detect whether the brain has tumor or not.

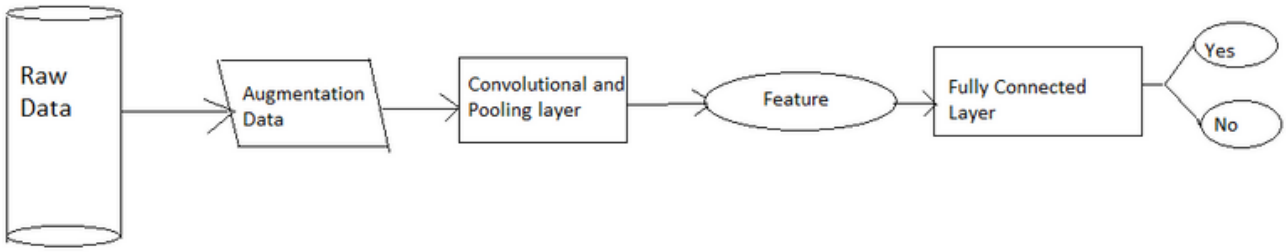

Figure : Method Proposed

Image Preprocessing: The MRI images will be cropped using OpenCV so that extra parts except the brain will not be there . Otherwise there might be a problem of underfitting. We will be finding four extreme points to crop the image. Finding extreme points in OpenCV :- https://pyimagesearch.com/2016/04/11/finding-extreme-points-in-contours-with-opencv/

Model CNN: Our CNN model will be having several layers such as Convolutional layer , Pooling layer, Flatten layer etc. The element involved in the convolution operation in the first part of a Convolutional Layer is called the Kernel/Filter, K. We have selected K as a k1 x k2 matrix. The pixel matrix of our input image is traversed and a matrix multiplication is done between the current window of our input matrix and K. The values are stored in another matrix C (m-k1+1) x (n-k2+1) it is called feature map .After that we will be passing C through another pooling layer that will reduce the dimensions of C. The next step is a flatten feature map in vector form to carry out a fully-connected layer process to produce a classification.

Chapter 6

Software Requirement Specifications

Chapter 6

Software Requirement Specifications

Our requirement is to detect a tumor from MRI images of brain.This will require handling files , managing paths in the system processing the image. Then classifying if it has tumor or not. We can convert the model into an stand alone or web application that will be used in medical sectors. If the model gives us good accuracy then we can add some extra features in it. Such as detecting the malignancy of the tumor.

Our model will be built using Python 3.x and it will be using several inbuilt libraries such as Numpy, Pandas , Tensorflow, Keras, OpenCV etc. Currently , we will be working in windows OS.

This model can be converted into an application where database will store the labelled images and the UI will be showing results. We can make it a browser based application using Flask framework.

Our model is using dataset of labelled images of MRI scan of human brain where some are labelled YES if the image of the brain has tumor and rest of them NO.

We will be using Numpy to handling calculations on multi-dimensional arrays that will be extracted from images. We will be using OpenCV in image processing and Matplotlib in case of visualizing the data. We will also use OS library to handle different directories in the system.

Chapter 7

Conclusion & Bibliography

Chapter 7

Conclusion

A Deep Learning model is developed to predict the probability of brain tumor likelihood. The model is made by using a convolution neural network (CNN) and image preprocessing techniques. Image preprocessing is done to reduce the false positives or noise in the image and fitting all images to one scale avoiding high bias by model. Ground Truth Labelling of the images is introduced in order to train the model. An effective algorithm is developed successfully by incorporating some hidden convolution layers in the CNN. Better validation accuracy is obtained while training the model by varying epochs and also either by adding or removing layers of CNN. The best weights of the model are saved while training the model by observing the validation and training accuracy. The model has various advantages of decreasing the cost if adopted
by the hospitals in the future. The other benefits are time reduction in analyzing, early diagnosis, and better accuracy. Further, this work can be extended by improving the accuracy, converting it into GUI Support, and using it in the Hospitals for a better life.

Chapter 7

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