BRAIN TUMOR DETECTION

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Introduction

- 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
- It requires an early and accurate detection method.
- Magnetic resonance imaging (MRI) is the imaging technique used to diagnose brain tumor disease

Introduction

- Deep learning has been widely applied in various fields including medical imaging because It’s application doesn’t require the reliability of an expert in the related field, but require a huge amount of diverse data to produce a good classification.

- Deep Learning is a handy and effective method for image classification. Convolutional Neural Network (CNN) is one the deep learning technique to perform image classification.

Problem Statement

In this work we will design a Brain Tumor Detection Model Using convolutional neural network.

In this the MRI Images are taken as a input dataset, then the pre-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. Then we train the model. 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.
- Now most detection and diagnosis method depends on decision of neuro-specialist, and radiologist for image evaluation which possible to human error and time consuming.
- The main purpose of the project is to build a robust CNN model that can classify if the subject has a tumor or not based on Brain MRI scan images with an acceptable accuracy for medical grade application.

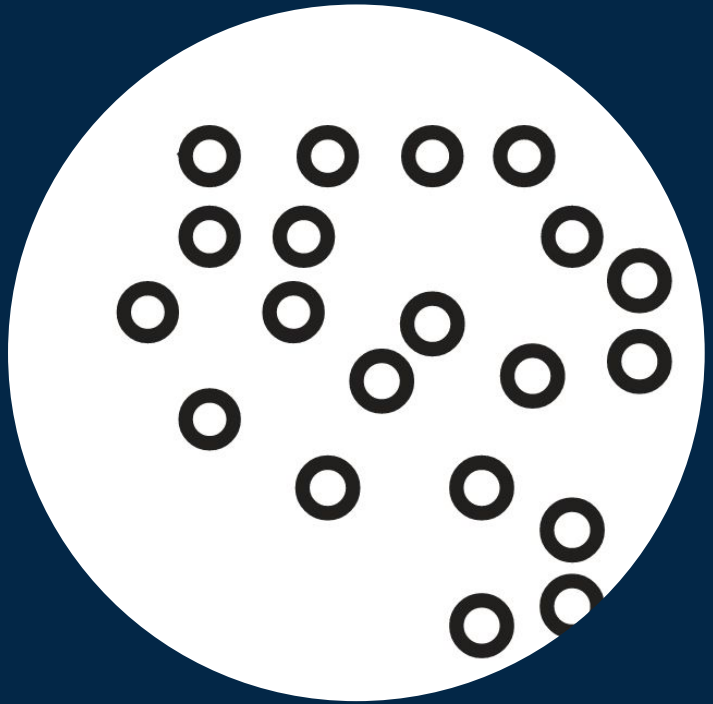
Literature Overview

- 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.
- Classification of brain tumors using a wavelet-based feature extraction method and Support Vector Machine (SVM).

Literature Overview

- A fully automated segmentation system 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.
- 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.

Why CNN?



- It’s very much suitable for image recognition.
- It’s most suitable for problem solving approach. It solves the problem in end to end manner instead of breaking it into different parts & then combines the result at final stage.
- It helps to avoid needless costs.
- It lessens the need for feature engineering.

Feasibility Study

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.

Feasibility Study

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-tumordetection. 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.

Image Preprocessing

- Artifacts are some extra features that are not related to original image. These features are introduced in the image during image acquisition.
- Artifacts and intensity variation affect the quality of analysis. So we need an efficient rectifying methodology for the removal of artifacts and intensity variation present in the image.
- Pre-processing techniques makes the image suitable for further processing; it enhances the quality of the image and finally removes the noise present in the Image.

Image Preprocessing

- Pre-Processing techniques aim the enhancement of the image without altering the information content.
- Here we discuss most relevant and important pre-processing techniques for MRI images before dealing with brain tumour detection and segmentation.
- 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. After that those images will be passed through our CNN model.

Dataset

As dataset we will be using MRI images of brain labelled as yes if the image has tumor and no if it does not have tumor. The datasets are downloaded from kaggle.com. It is supposed to have around 200 MRI images of brain. The images are taken in .jpg format.

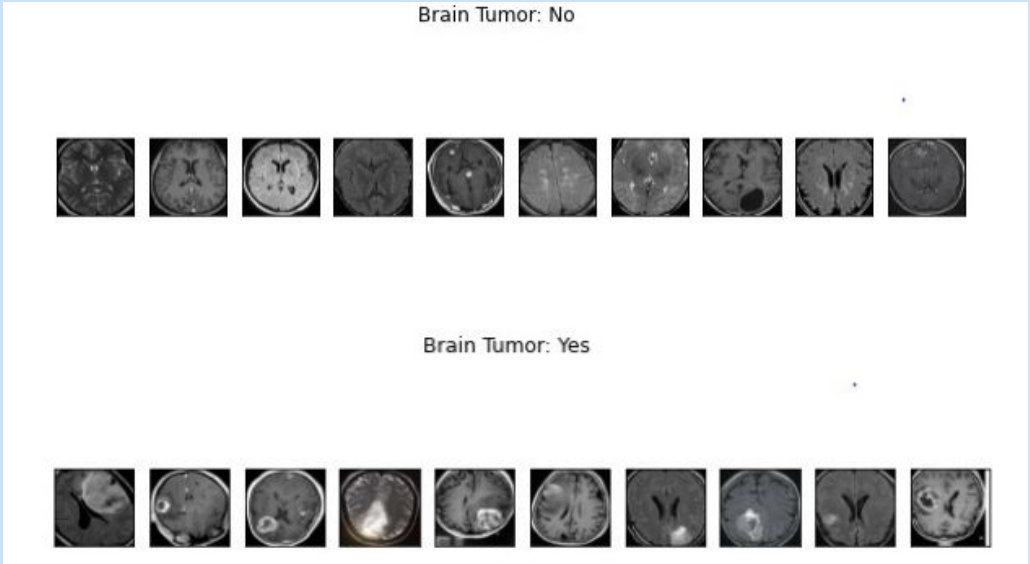
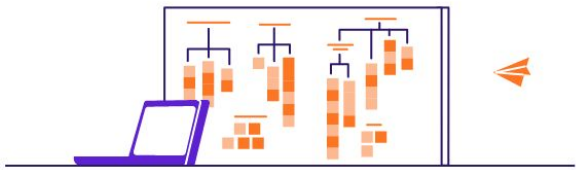
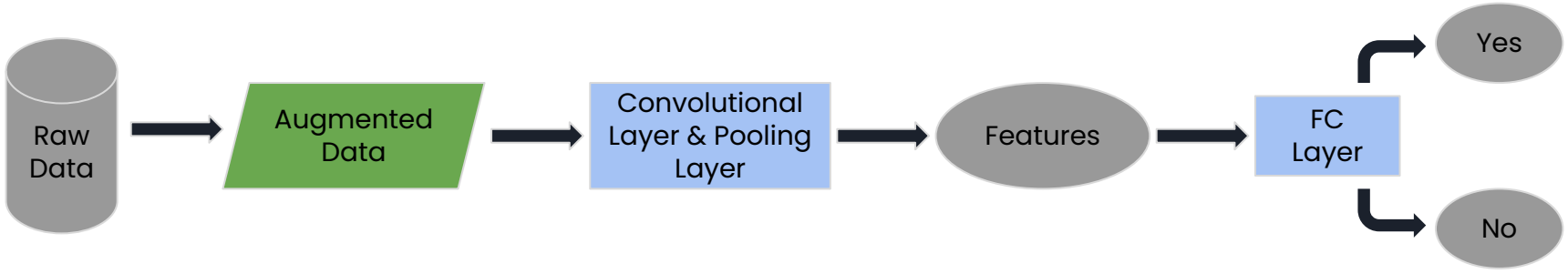


Fig: Sample Dataset

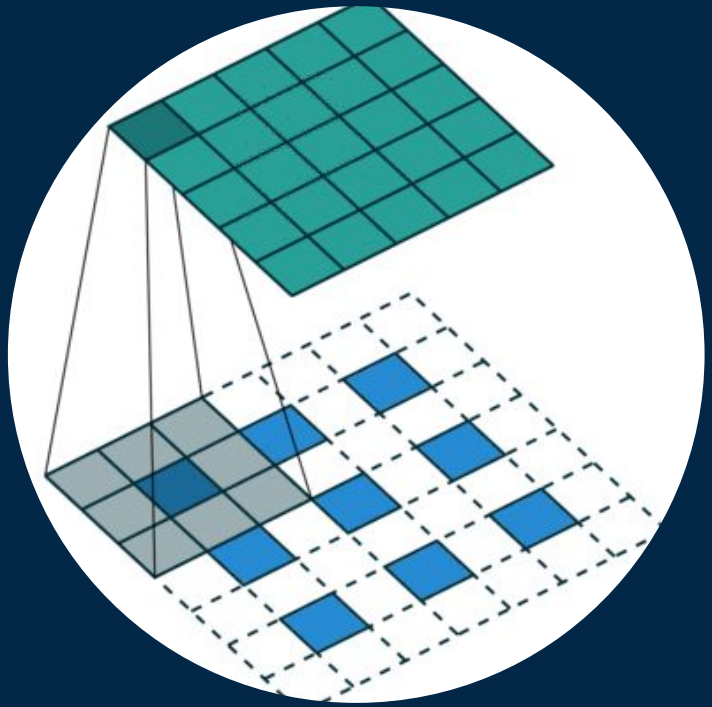
Proposed Scheme



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.



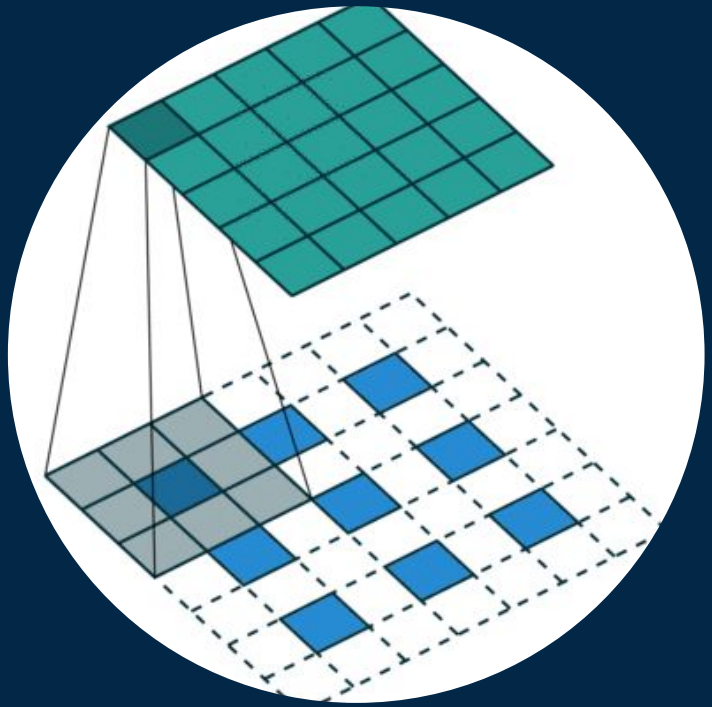
Proposed Scheme



Model CNN: Our CNN model will be having several layers such as Convolutional layer , Pooling layer, Flatten layer etc.

- **Convolutional layer :**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 .

Proposed Scheme



- **Pooling layer:** After that we will be passing C through another pooling layer that will reduce the dimensions of C. Like convolutional layer this layer also slides a filter across the input image.This layer reduces complexity and improves the efficiency of the CNN.
- **Fully connected layer:** The next step is a flatten feature map in vector form . It will be carried out a fully-connected layer process to produce a classification. The FC layer is where image classification happens in the CNN based on the features extracted in the previous layers. Here, *fully connected* means that all the inputs or nodes from one layer are connected to every activation unit or node of the next layer.

Technology Used

- This project will be implemented using Python 3.x as it has very rich collection of inbuilt libraries for implementing Machine learning models.
- We will be using OpenCV for image processing.
- Numpy will be used to handle arrays
- We will be using Keras to implement CNN layers (Convolutional layer , Pooling layer, Flatten layer etc)
- We will be using Keras to build and train the model.
- Matplotlib will be used to plot the images

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.
- 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.
- 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.

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.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.

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