Brain Tumor Classification Using Deep Learning

Project 4 - Team 4

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Motivation

The WHO classifies Brain Tumor on a scale of Grade I to Grade IV.

The complexity in brain tumor is due to a lot of variations in tumor location and size.

Often times in developing countries the lack of skillful doctors and lack of knowledge about tumors makes it really challenging and time-consuming to generate reports from MRI's.

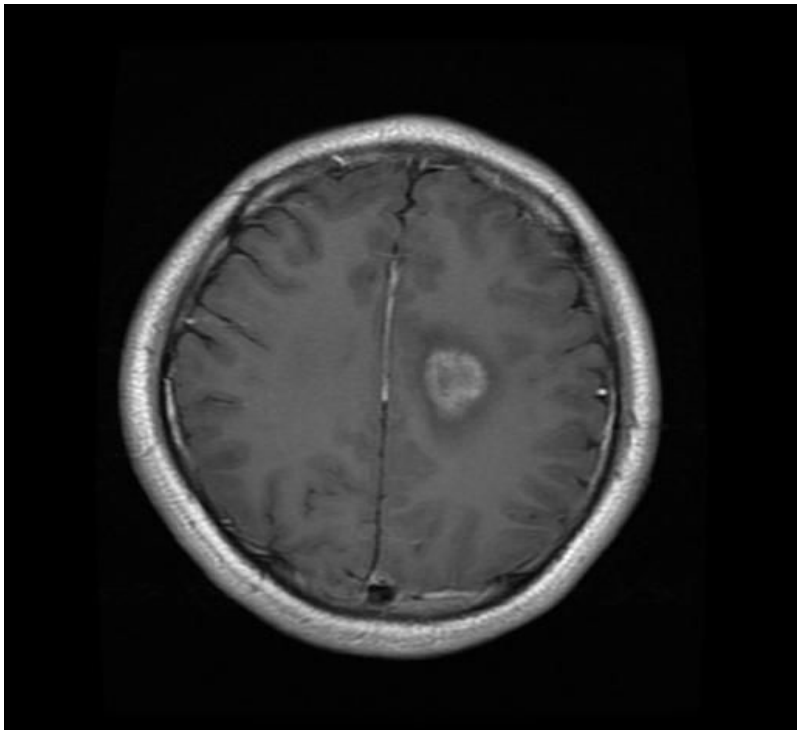
Thus automation of this diagnostic process would be helpful.

Problem Statment

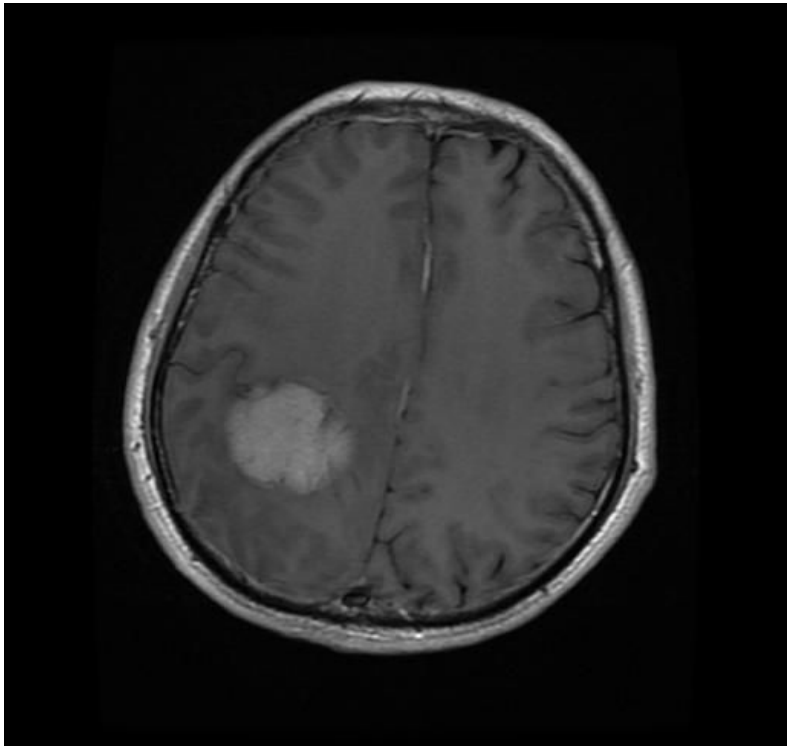
To Detect and Classify Brain Tumor using CNN, ANN and TL as an asset of Deep Learning and to deploy a Flask system for so.

Classifying Tumor Example :

Glioma.(Cancerous)



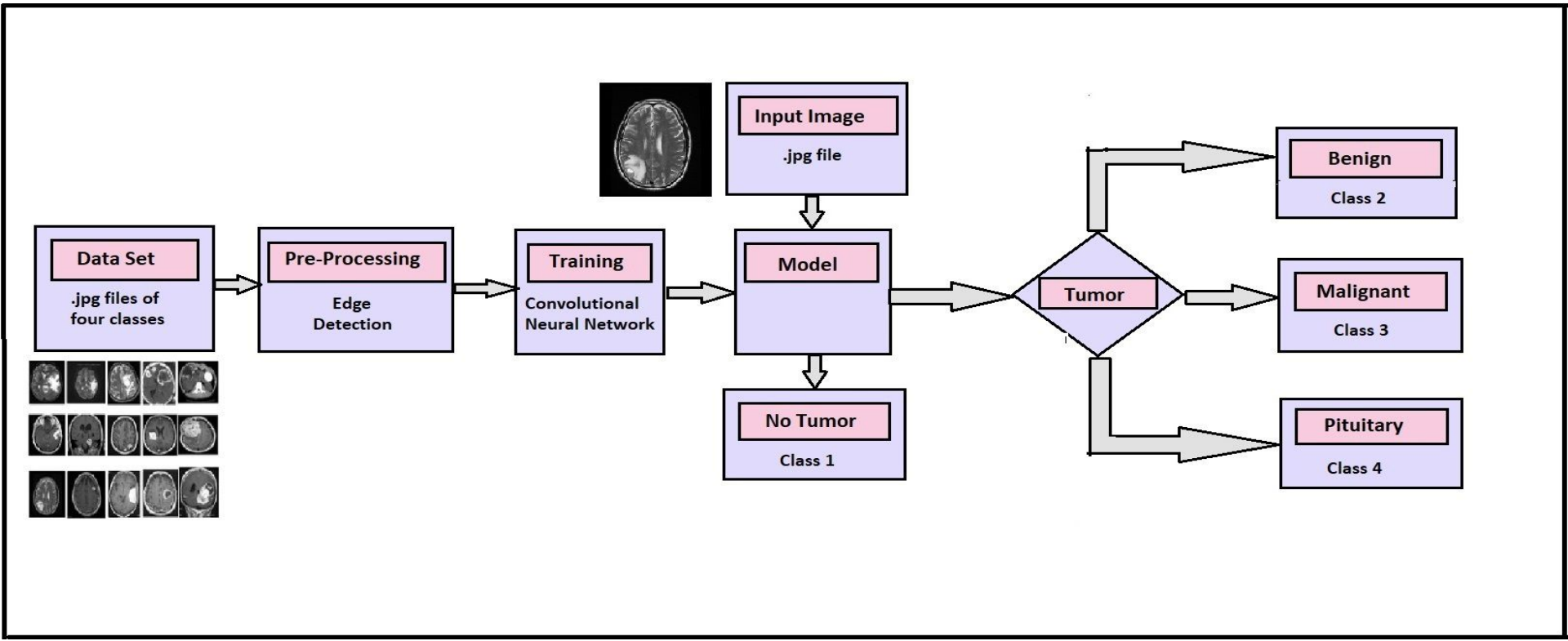
Meningioma(Non - Cancerous)



Introduction

- The tumor classes are Benign (Non - Cancerous) and Malignant (Cancerous).
- A Pituitary Tumor is a Benign tumor that starts in the pituitary gland.
- This is a 4 class problem.
- Our proposed automation system would take an MRI and analyze it to find tumors.

Architecture Diagram:



Objectives

- To identify if the MRI image of the patient has Brain Tumor or not.
- If Yes, classify the brain tumor into three types, as follows:
- Benign Tumor
- Malignant Tumor
- Pituitary Tumor

Data Sets:

Kaggle : Brain Tumor Image Dataset
https://www.kaggle.com/navoneel/brain-mri-images-for-brain-tumor-detection

Data:

Our project aims to classify MRIs into four classes which makes it a four-class problem. Data for our Neural Networks is in image format(.jpg). This data is collected from Kaggle(

Image Cropping:

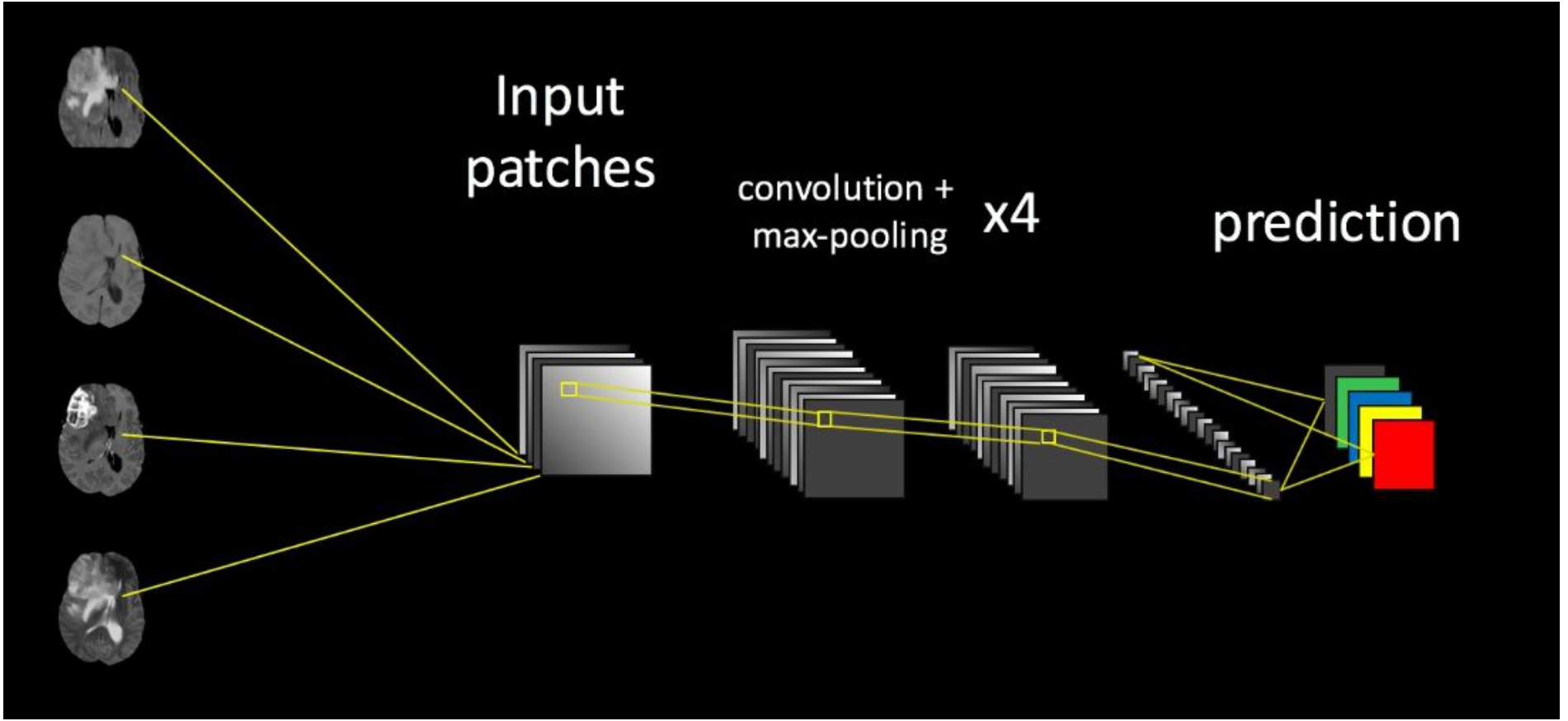
The MRIs contain a black background around the central image of the brain. This black background provides no useful information about the tumor and would be waste if fed to neural networks. Hence cropping the images around the main contour would be useful. For this we use cv2.findContours() from the ‘cv2’ library.

Pickling :

Thus we convert these images into four NumPy arrays of X_train, Y_train, X_test, Y_test. Where X_train, X_test contain the images and Y_train, Y_test contain the labels.

Saving these files as pickle helps us save all our progress in the pre-processing stage using ‘pickle.dump()’. And we can later directly use these pickle files to be input to all our neural networks. Thus it helps us save time by not pre-processing every time we want to train a network. The next time we just use ‘pickle.load’ to load all the data.

Building the network



Model Building :

Artificial Neural Network (ANN):

The model with the highest accuracy is model with 128 nodes-0 dense layers with an accuracy of 80% Not bad for ANN. But the accuracy does not go over 80% no matter how many layers we add. Thus lack of Convolution layers stops our thrive for higher accuracy.

Convolution Neural Networks (CNN) :

The models are generated with a combination of these parameters. Thus we generate a total of 21 models. In which the model ‘3-conv-128-nodes-1-dense’ has the highest accuracy of 91%

Transfer Learning (TL):

which VGG16 had the highest testing accuracy of 94% and an F1-Score of 94! Thus this model outperformed all our ANN, CNN and TL models.

Future Scope

- Improved Diagnostics.
- Covering more number of classes of Brain Tumor.
- Accurate Growth Rate Prediction of Tumor.
- Reduction in Medical Negligence.

Flask Deployment :

Let’s use Flask- a Web Application Framework based on python.

Scope of Project

Build models using ANN and CNN algorithms.

Compare those models over various parameters.

Selecting best algorithm for MRI classification.

Display of growth or shrinkage of Tumor.

Reduction in Medical Negligence or Human Error.