Brain Tumour Detection Using Morphological filtering and CNN

A Mini Project Report Submitted
In partial fulfillment of the requirement for the award of the degree of

Bachelor of Technology
in
Computer Science and Engineering – Artificial Intelligence and Machine Learning

By

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2020-2024

DECLARATION

I hereby declare that the project entitled "**Brain tumour detection using Morphological filtering and CNN**" submitted to **Malla Reddy College of Engineering and Technology**, affiliated to Jawaharlal Nehru Technological University Hyderabad (JNTUH) for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering – Artificial Intelligence and Machine Learning** is a result of original research work done by us.

It is further declared that the project report or any part thereof has not been previously submitted to any University or Institute for the award of degree or diploma.

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CERTIFICATE

This is to certify that this is the bonafide record of the project titled **"Brain tumour detection using Morphological filtering and CNN"** submitted by **Vangala Sathwika(20N31A6658)**, **Adurthi Mahathi Chinmayee(20N31A6601), Challa Harika(20N31A6608)** of B. Tech in the partial fulfillment of the requirements for the degree of **Bachelor of Technology** in **Computer Science and Engineering-Artificial Intelligence and Machine Learning**, Dept. of CI during the year 2022-2023. The results embodied in this project report have not been submitted to any other university or institute for the award of any degree or diploma.

Dr Arundhati das
Associate Professor

INTERNAL GUIDE

Dr D. Sujatha
Professor,

HEAD OF THE DEPARTMENT

EXTERNAL EXAMINER

ACKNOWLEDGEMENTS

We feel honored to place our warm salutation to our college **Malla Reddy College of Engineering and Technology (UGC-Autonomous)** for giving us an opportunity to do this Project as part of our B.Tech Program. We are ever grateful to our Director **Dr. VSK Reddy** and Principal **Dr. S.Srinivas Rao** who enabled us to have experience in engineering and gain profound technical knowledge.

We express our heartiest thanks to our HOD, **Dr. D. Sujatha** for encouraging us in every aspect of our course and helping me realize my full potential.

We would like to thank our Project Guide **Dr Arundhati das** for her regular guidance, suggestions and constant encouragement.

We are extremely grateful to our Project Coordinator **Mr P. Hari Krishna** sir for his continuous monitoring and unflinching co-operation throughout project work.

With regards and gratitude

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Degree: Bachelor of Technology in Computer Science and Engineering-Artificial Intelligence and Machine Learning

Department: computational Intelligence

Title of the project: Brain tumour detection using Morphological filtering and CNN

Date:

ACKNOWLEDGEMENT

We express our sincere thanks **to Dr. S. Srinivas Rao**, Principal, MRCET, for facilitating us to carry out our Project Work inside the Campus and for providing us with all the necessary facilities and for his constant encouragement. This is with sincere gratitude that we would like to express our profound thanks to our Head of the Department of Computer Science and Engineering, **Dr. D. Sujatha** for her valuable guidance and support. She has been a constant source of encouragement and inspiration for us in completing this work.

This is with sincere gratitude that we would like to express our profound thanks to our project coordinator **Mrs. P. Hari Krishna,** for his valuable guidance and support. He has given a constant source of encouragement and inspiration for us in completing this work.

This is with sincere gratitude that we would like to express our profound thanks to our project guide **Dr Arundhati das**, Department of Computer Science and Engineering, for his valuable guidance and support. She has been a constant source of encouragement and inspiration for us in completing this work. Finally, we express our sincere thanks to our family members for their continuous co-operation and encouragement extended during the project work.

with regards and gratitude

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ABSTRACT

Brain tumour detection is a hazardous task in medical imaging for detecting the tumour which plays a key role in patient outcomes. Brain tumours have continued to increase for the last decade in several countries. Medical images play a very important role in making the right diagnosis for the doctor and in the patient's treatment process. In this work, we are developed an approach which is a combination of both morphological filtering and convolutional neural networks (CNNs). Firstly, we employ morphological filtering on the brain MRI images. The pre-processing phase uses of morphological filtering to enhance the features of the brain MRI image and to remove any unwanted noise. The filtered images are then fed into a CNN model with a unique architecture that includes multiple convolutional and pooling layers. The CNN model learns and extracts the important features from the filtered images and predicts the presence of a tumour. The method can accurately describe the texture features of the shallow layer of the tumour image, thereby enhancing the robustness of the image region description. The CNN model is trained using a large dataset of brain MRI images to identify the presence of tumours. The proposed method provides a simple yet effective way of detecting brain tumours that can aid physicians in making accurate diagnoses and treatment plans.

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TABLE OF CONTENTS

1: INTRODUCTION

A brain tumour is a mass or growth of abnormal cells in the brain. Brain tumours can be cancerous (malignant) or noncancerous (benign). One of the tests to diagnose brain tumour is magnetic resonance imaging (MRI).In the field of Medical Image Analysis, research on Brain tumors is one of the most prominent ones.Primary brain tumors occur in around 250,000 people a year globally, making up less than 2% of cancers!.Tumor segmentation is one of the most difficult task in medical image.Classification of the tumor as tumorous or non-tumorous is the primary task.

1.1 Purpose

The purpose of using Convolutional Neural Network (CNNs) for the brain tumour detection is to accurately classify medical images as either containing a tumour or not. Early detection of brain tumour is critical for successful treatment, and medical imaging techniques such as Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) are commonly used for diagnosis.

CNNs are a type of deep learning algorithm that have shown to very effective in image recognition tasks.The use of CNNs for brain tumour detection has the potential to improve the accuracy and speed of diagnosis, leading to earlier detection and treatment of brain tumour

1.2 Project features

Firstly, we should take the standard dataset and perform morphological filtering as a pre-processing Techniqu e.Then we apply CNN model for the dataset and find the accuracy. Our project detects the whether tumor is p resent or not.and also if tumor is detected it shows which type of tumor he/she is suffering with using MRI Images.

1.3 Scope of the Project

In this project, the scope of the brain tumour detection project using CNN will depend on the specific goals and requirements of the project. However, it is essential to consider aspects such as data collection,model development, visualization ,integreation, deployment, and evaltion to ensure the project’s success .

1.4 Modules Description

1.4.1 Deep Learning Frame works

TensorFlow: TensorFlow serves as a core platform and library for machine learning. TensorFlow's APIs use to allow keras users to make their own machine learning models. In addition to building and training their model, TensorFlow can also help load the data to train the model, and deploy it using TensorFlow Serving.

Keras: Keras is a deep learning API written in Python, running on top of the machine learning platform TensorFlow. It was developed with a focus on enabling fast experimentation. Being able to go from idea to result as fast as possible is key to doing good research.

2: SYSTEM REQUIREMENTS

2.1 Hardware requirements

- Processor: 8th Gen and above, i5 intel core and above.
- Ram: 4 GB or more.
- Hard disk: 10GB of available space or more.

2.2 Software requirements

- Operating System: Windows XP or Higher versions
- Language: Python [version 3.8 or later]

- Modules:

Keras

TensorFlow

2.3 Non-Functional Requirements

The purpose of this project is to ensure that the brain tumour detection project using CNN meets the necessary performance standards, security requirements, usability standards, security maintainability criteria.

2.4 Safety Requirements:

Safety requirements are crucial for any project that involves the detection of brain tumours using CNN. B y ensuring patient safety, accuracy, reliability, clinical safety, usability, maintenance, updates, and security, m edical professional can use the application or platform safely and effectively to help diagnose and treat brain tumours

2.5 Security Requirements:

. It must be ensured that access will be provided to the authorized persons through user ID and Password.

. Network security will be provided by the use of firewalls.

3: TECHNOLOGY USED

3.1 GOOGLE COLAB

Colab is a free Jupyter notebook environment that runs entirely in the cloud. Most importantly, it does not require a setup and the notebooks that you create can be simultaneously edited by your team members - just the way you edit documents in Google Docs. Colab supports many popular machine learning libraries which can be easily loaded in your notebook.

4: SYSTEM DESIGN

This Main purpose of this project is to detect the brain tumour using CNN that he/she occurring with.

4.1 SYSTEM ARCHITECTURE

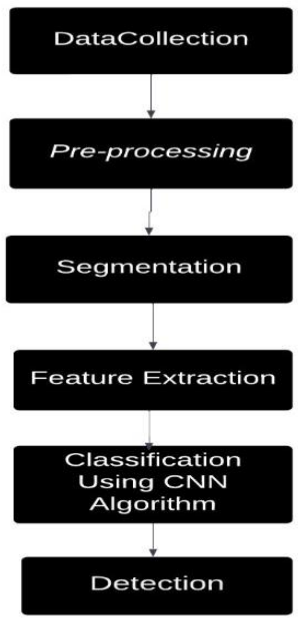


FIG.4.1.1 (Process of Brain tumour detection)

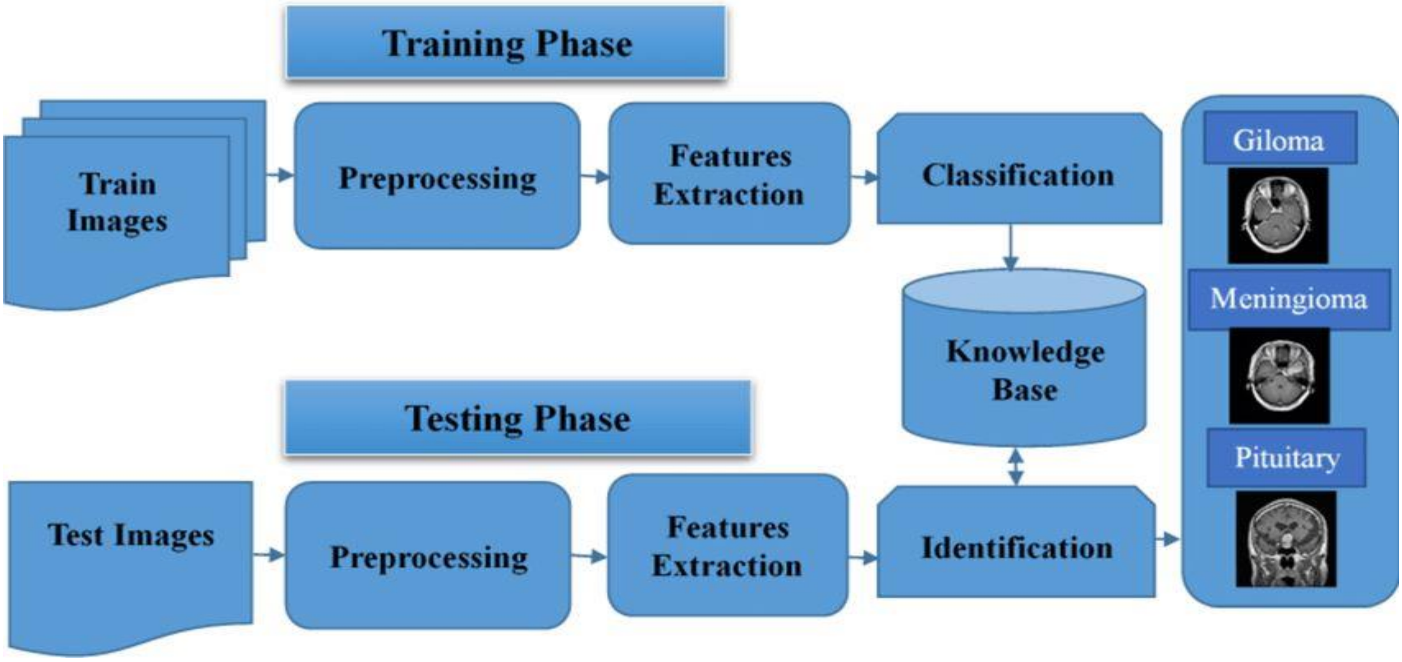
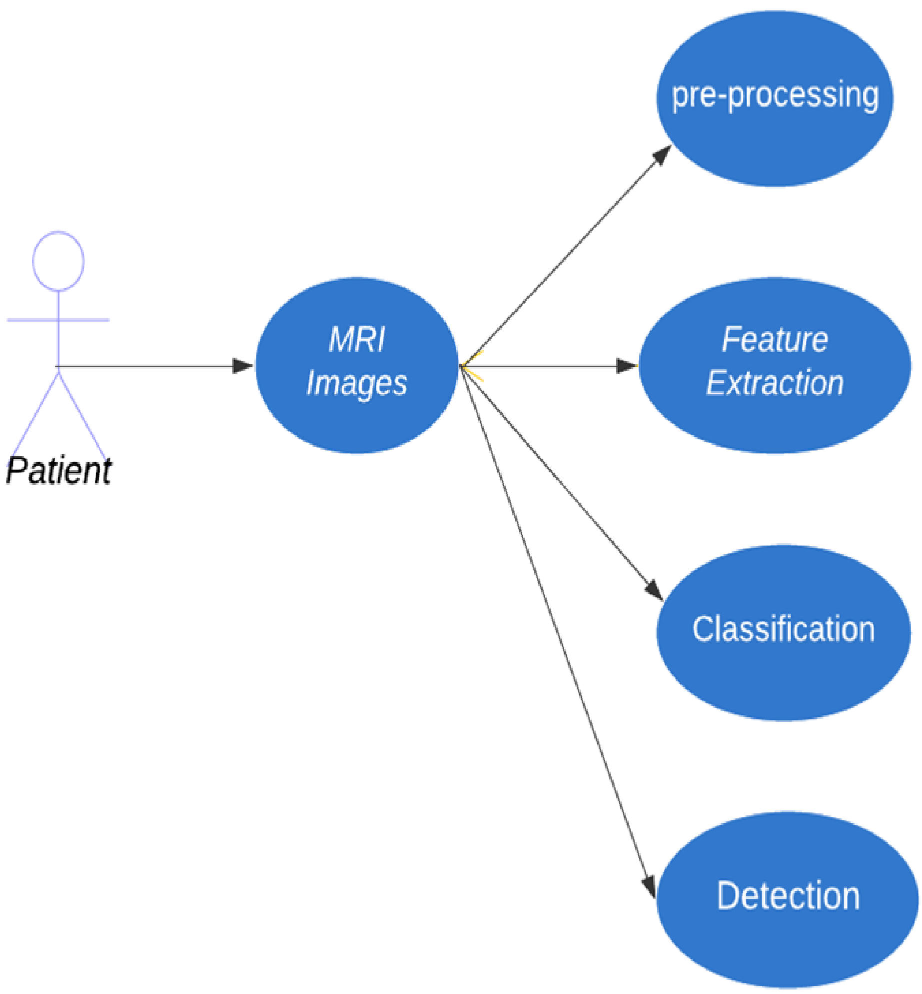


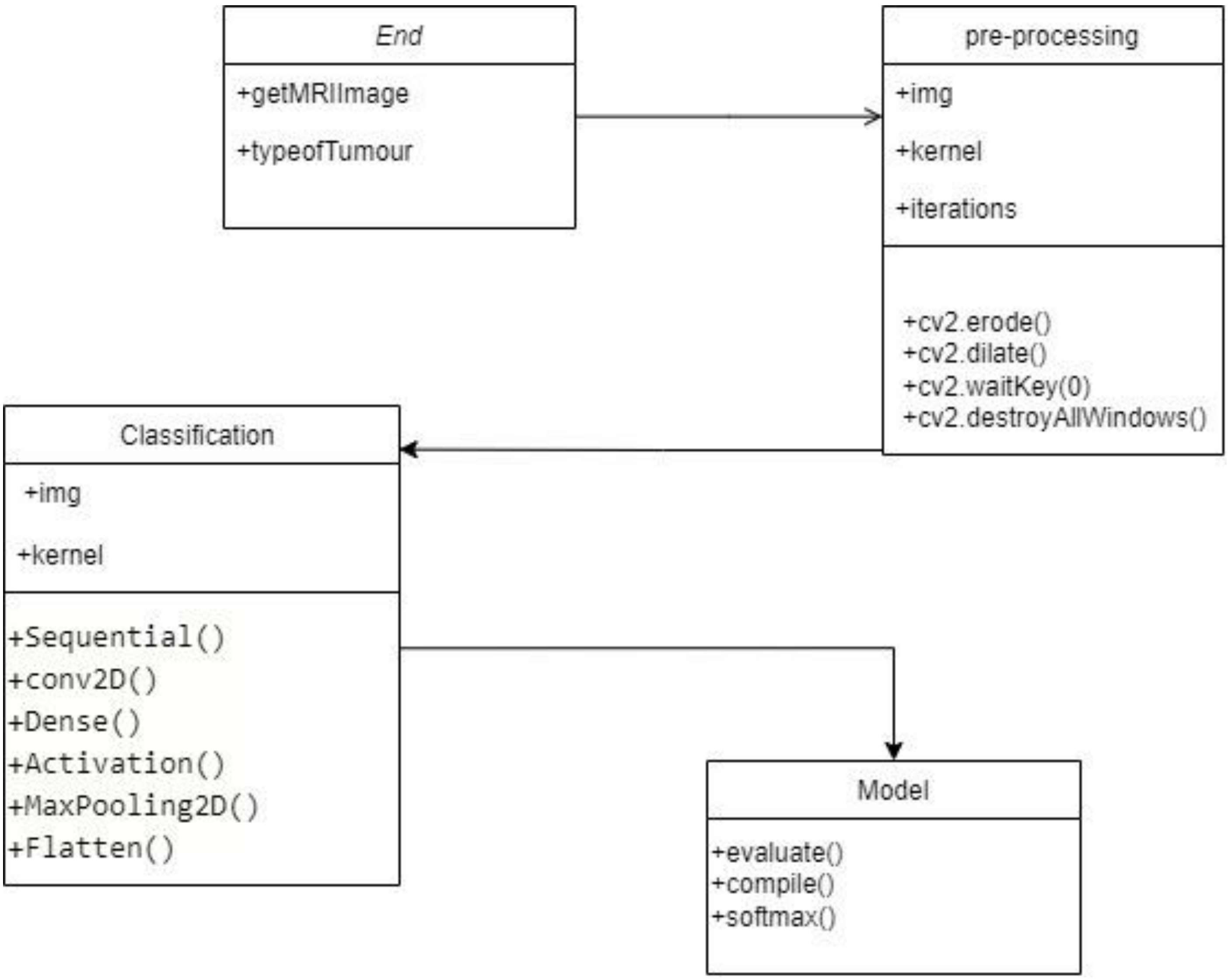
FIG.4.1.2 (Flowchart of the brain tumour detection)

4.2: UML DIAGRAMS

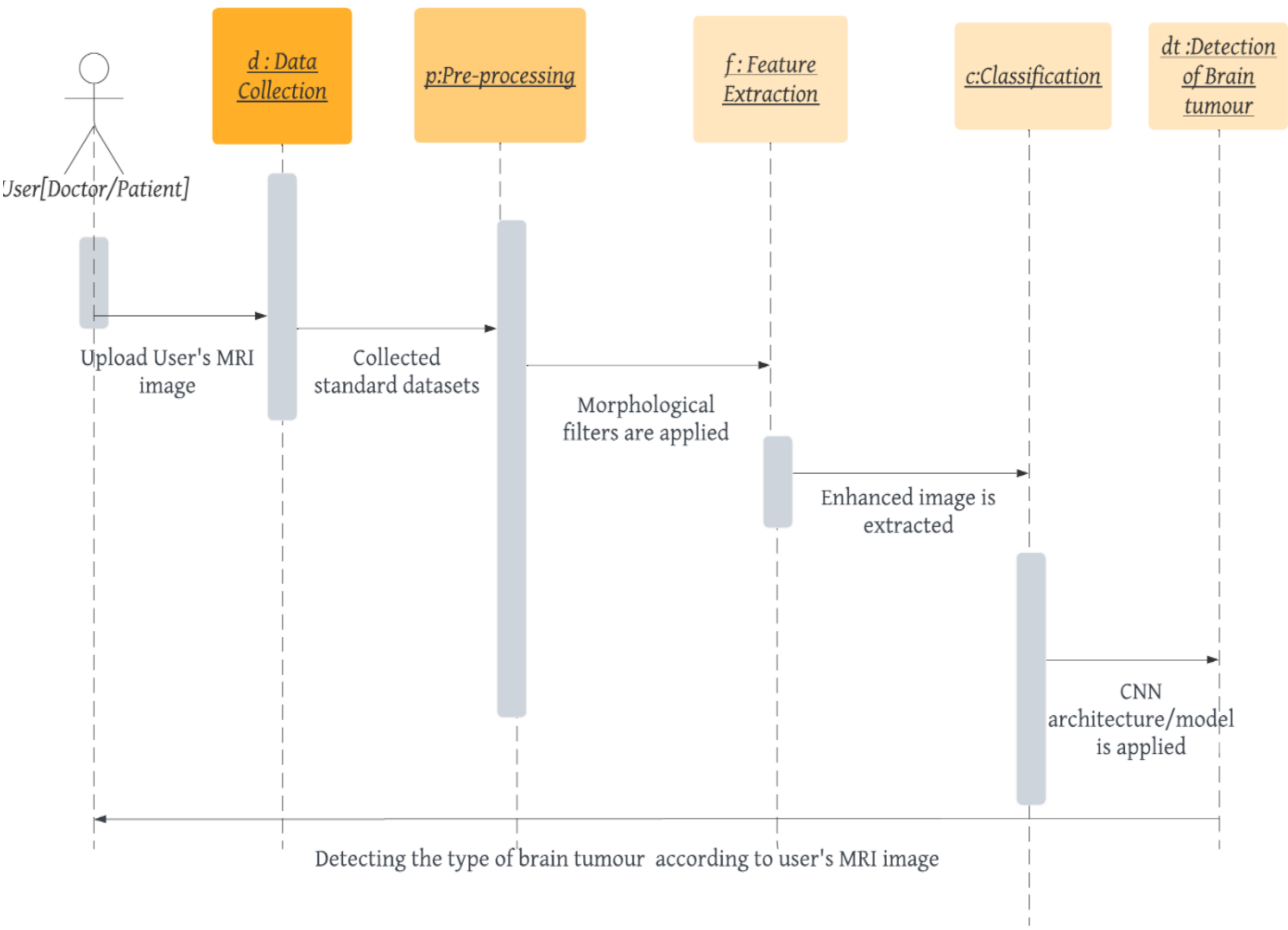
4.2.1 USE CASE DIAGRAM



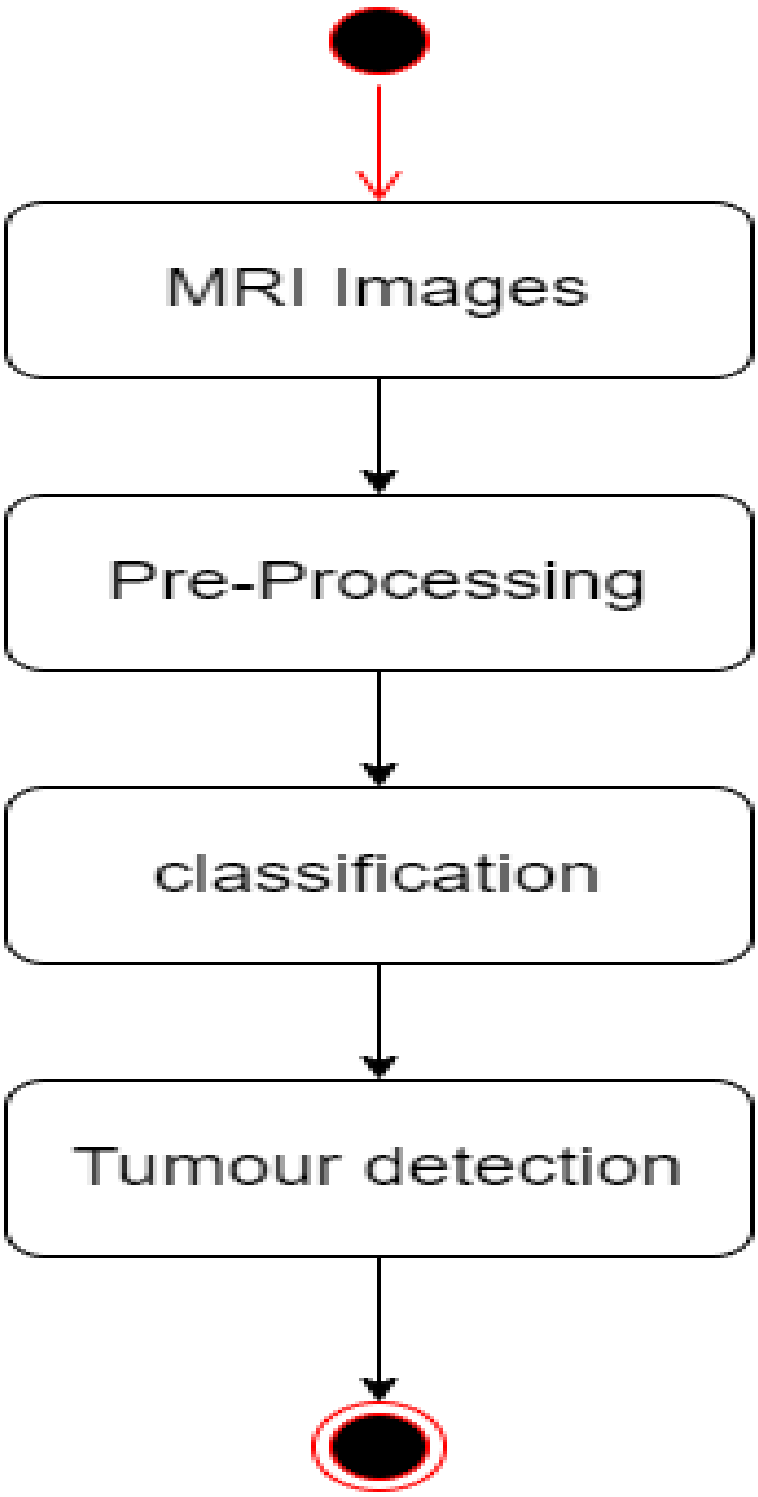
4.2.2 CLASS DIAGRAM



4.2.3 SEQUENCE DIAGRAM



4.2.4 ACTIVITY DIAGRAM



5. IMPLEMENTATION

5.1 SOURCE CODE

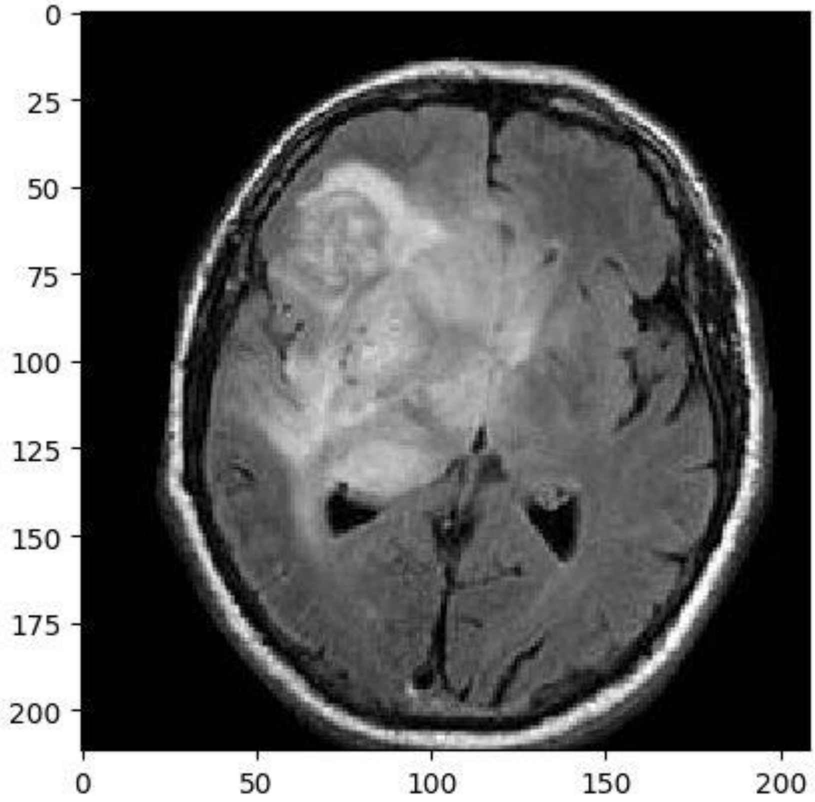
```
import numpy as np # linear algebra
import pandas as pd

from google.colab import drive
drive.mount('/content/drive')

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

import keras
from keras.models import Sequential
from keras.layers import Conv2D,Flatten,Dense,MaxPooling2D,Dropout
from sklearn.metrics import accuracy_score

import ipywidgets as widgets
import io
from PIL import Image
import tqdm
from sklearn.model_selection import train_test_split
import cv2
from sklearn.utils import shuffle
import tensorflow as tf

X_train = []
Y_train = []
image_size = 150
labels = ['glioma_tumor','meningioma_tumor','no_tumor','pituitary_tumor']
for i in labels:
    folderPath = os.path.join('/content/drive/MyDrive/archive (6)/Training',i)
    for j in os.listdir(folderPath):
        img = cv2.imread(os.path.join(folderPath,j))
        kernel = np.ones((5,5),np.uint8)
        img = cv2.erode(img, kernel, iterations=1)
        img = cv2.dilate(img, kernel, iterations=1)
```

```
        # Resize image to a fixed size (optional)
        img = cv2.resize(img,(image_size,image_size))
        X_train.append(img)
        Y_train.append(i)

for i in labels:
    folderPath = os.path.join('/content/drive/MyDrive/archive (6)/Testing',i)
    for j in os.listdir(folderPath):
        img = cv2.imread(os.path.join(folderPath,j))
        kernel = np.ones((5,5),np.uint8)
        img = cv2.erode(img, kernel, iterations=1)
        img = cv2.dilate(img, kernel, iterations=1)
        img = cv2.resize(img,(image_size,image_size))
        X_train.append(np.array(img))
        Y_train.append(i)

X_train = np.array(X_train)
Y_train = np.array(Y_train)

X_train,Y_train = shuffle(X_train,Y_train,random_state=101)
X_train.shape

X_train,X_test,y_train,y_test  =
train_test_split(X_train,Y_train,test_size=0.1,random_state=101)

y_train_new = []
for i in y_train:
  y_train_new.append(labels.index(i))
y_train=y_train_new
y_train = tf.keras.utils.to_categorical(y_train)

y_test_new = []
for i in y_test:
  y_test_new.append(labels.index(i))
y_test=y_test_new
y_test = tf.keras.utils.to_categorical(y_test)

from keras.models import Sequential
model = Sequential()
model.add(Conv2D(32,(3,3),activation = 'relu',input_shape=(150,150,3)))
model.add(Conv2D(64,(3,3),activation='relu'))
model.add(MaxPooling2D(2,2))
model.add(Dropout(0.3))
model.add(Conv2D(64,(3,3),activation='relu'))
model.add(Conv2D(64,(3,3),activation='relu'))
model.add(Dropout(0.3))
model.add(MaxPooling2D(2,2))
model.add(Dropout(0.3))
model.add(Conv2D(128,(3,3),activation='relu'))
model.add(Conv2D(128,(3,3),activation='relu'))
model.add(Conv2D(128,(3,3),activation='relu'))
```

```
model.add(MaxPooling2D(2,2))
model.add(Dropout(0.3))
model.add(Conv2D(128,(3,3),activation='relu'))
model.add(Conv2D(256,(3,3),activation='relu'))
model.add(MaxPooling2D(2,2))
model.add(Dropout(0.3))
model.add(Flatten())
model.add(Dense(512,activation = 'relu'))
model.add(Dense(512,activation = 'relu'))
model.add(Dropout(0.3))
model.add(Dense(4,activation='softmax'))

model.summary()

model.compile(loss='categorical_crossentropy',optimizer='Adam',metrics=['accuracy'])

history = model.fit(X_train,y_train,epochs=25,validation_split=0.1)

test_loss, test_acc = model.evaluate(X_test, y_test)
print('Test accuracy:', test_acc)

import matplotlib.pyplot as plt
import seaborn as sns

acc = history.history['accuracy']
val_acc = history.history['val_accuracy']
epochs = range(len(acc))
fig = plt.figure(figsize=(14,7))
plt.plot(epochs,acc,'r',label="Training Accuracy")
plt.plot(epochs,val_acc,'b',label="Validation Accuracy")
plt.legend(loc='upper left')
plt.show()

img = cv2.imread('/content/Y2.jpeg')
img = cv2.resize(img,(150,150))
img_array = np.array(img)
img_array.shape

img_array = img_array.reshape(1,150,150,3)
img_array.shape

from tensorflow.keras.preprocessing import image
img = image.load_img('/content/Y2.jpeg')
plt.imshow(img,interpolation='nearest')
plt.show()

a=model.predict(img_array)
indices = a.argmax()
indices
```

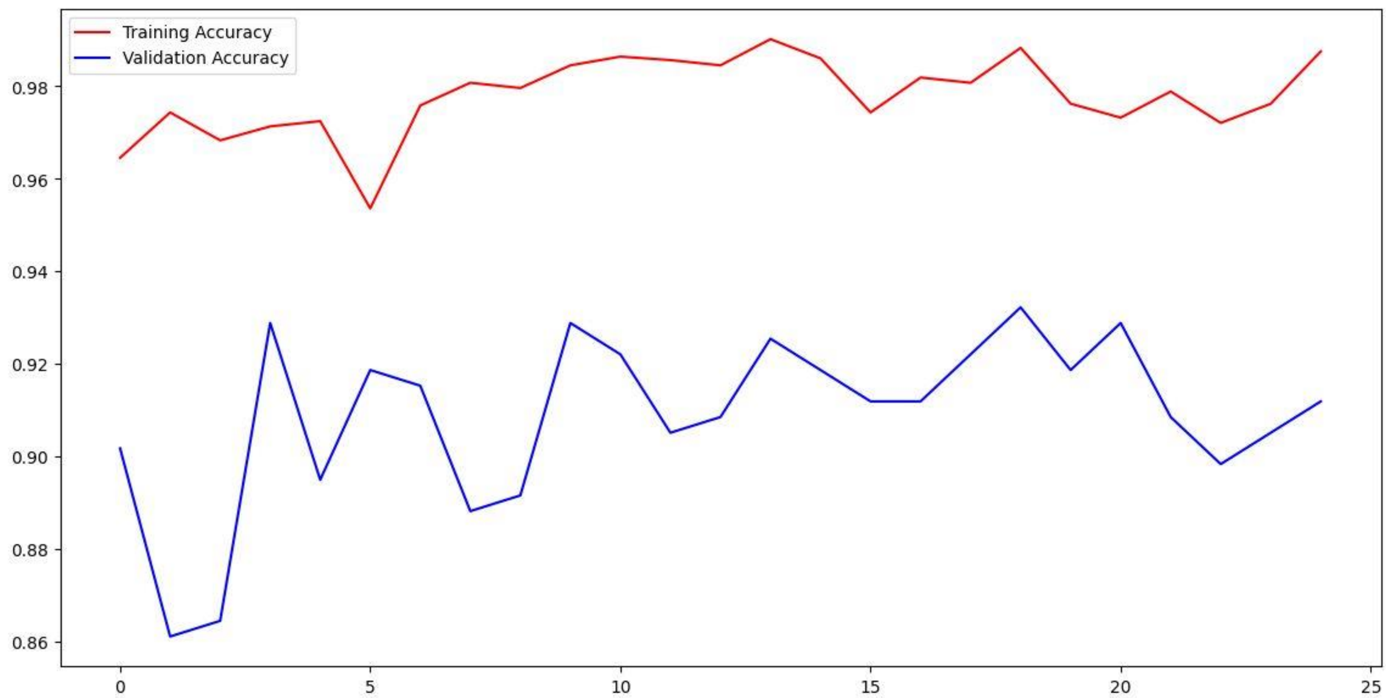
5.2 OUTPUT SCREENSHOTS

```
2 img = image.load_img('/content/Y2.jpeg')
3 plt.imshow(img,interpolation='nearest')
4 plt.show()
```




```
1 a=model.predict(img_array)
2 indices = a.argmax()
3 indices
```

```
1/1 [==============================] - 0s 485ms/step
0
```


Training Accuracy
Validation Accuracy
0.98
0.96
0.94
0.92
0.90
0.88
0.86
0
5
10
15
20
25

6: CONCLUSION

In conclusion, the use of morphological filtering and CNN for brain tumor detection has shown promising results in our studies. Morphological filtering can effectively enhance the features of brain images and extract important information that can be used for classification. CNNs are powerful tools for image recognition and can learn complex features and patterns from image data.

However, further research is needed to optimize the parameters of the morphological filters and CNNs and to test the method on a larger dataset. Additionally, the interpretability of the CNN models should be further investigated to ensure the reliability of the results. Overall, the use of morphological filtering and CNNs for brain tumor detection shows great potential for improving the accuracy and speed of diagnosis.

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