Brain Tumor Detection with Convolutional Neural Networks

This presentation outlines a project to develop a convolutional neural network (CNN) for accurate brain tumor detection and classification.

Under supervision :

Dr: Eman Raslan

CLS ONL1_AIS3_S1e

Made by :

- Arwa Mostafa Mohamed
- Salma Mahahmoud AbdElsalam
- Khaled Mahmoud Esmael
- Hadeer Khaled Ali
- Alyaa Mohamed AbdElfatah
- Mohamed Hesham Ahmed
- Ahmed Alaa Ibrahem

Agenda

- Project overview
- Problem statement
- Methodology
- Data Collection and Preprocessing
- Model Development
- Confusion Matrix
- Graphs

Project overview

The project aims to detect brain tumors in grayscale MRI images, with the objective of accurately identifying the presence of a tumor. Deep learning, specifically using convolutional neural networks (CNN), was applied to analyze the images. The model was trained and tested to achieve high accuracy in diagnosing brain tumors.

Problem Statement

The main challenge in diagnosing brain tumors is that interpreting MRI scans can be prone to errors, even for experienced radiologists. Factors like image quality and tumor size can make it difficult to analyze the scans accurately, potentially leading to missed or incorrect diagnoses.

Solution

Develop a deep learning model that accurately detects brain tumors in various grayscale MRI images, ensuring reliable performance across different image qualities and patient anatomies.

Software used

- **Python**: The programming language for developing the project.
- **Google Colab**: The cloud-based platform for coding and running the machine learning model.
- **OpenCV**: For image processing tasks, such as reading and resizing images.
- **PIL (Pillow)**: For image manipulation and conversion.
- **NumPy**: For handling numerical operations and array manipulations.
- **TensorFlow/Keras**: For building and training the Convolutional Neural Network (CNN).
- **Matplotlib**: For visualizing the training process, including accuracy and loss graphs.
- **Seaborn**: For creating informative and attractive statistical graphics, such as visualizing the confusion matrix.

Methodology

1 **Data Collection**

The dataset used for this project is the **Brain Tumor Detection MRI** dataset, sourced from Kaggle.

Link : Brain_Tumor_Detection_MRI (kaggle.com)

2 **Preprocessing**

Preparing the data for model training by resizing to 64×64 , and Labeling the Data 1 for tumor , 0 for normal.

3 **Model Development**

Implementing a CNN architecture for brain tumor detection, incorporating three convolutional layers, pooling layers, a fully connected dense layer, and an output dense layer with dropout for improved accuracy.

4 **Training**

The model was trained on 64x64 grayscale MRI images using a batch size of 16 for 10 epochs. After training, the model was saved for future use.

5 **Evaluation**

Assessing the model's performance using appropriate metrics like accuracy, confusion matrix on a separate test dataset.

Data Collection and Preprocessing

The project utilizes publicly available datasets of brain MRI scans annotated with tumor information.

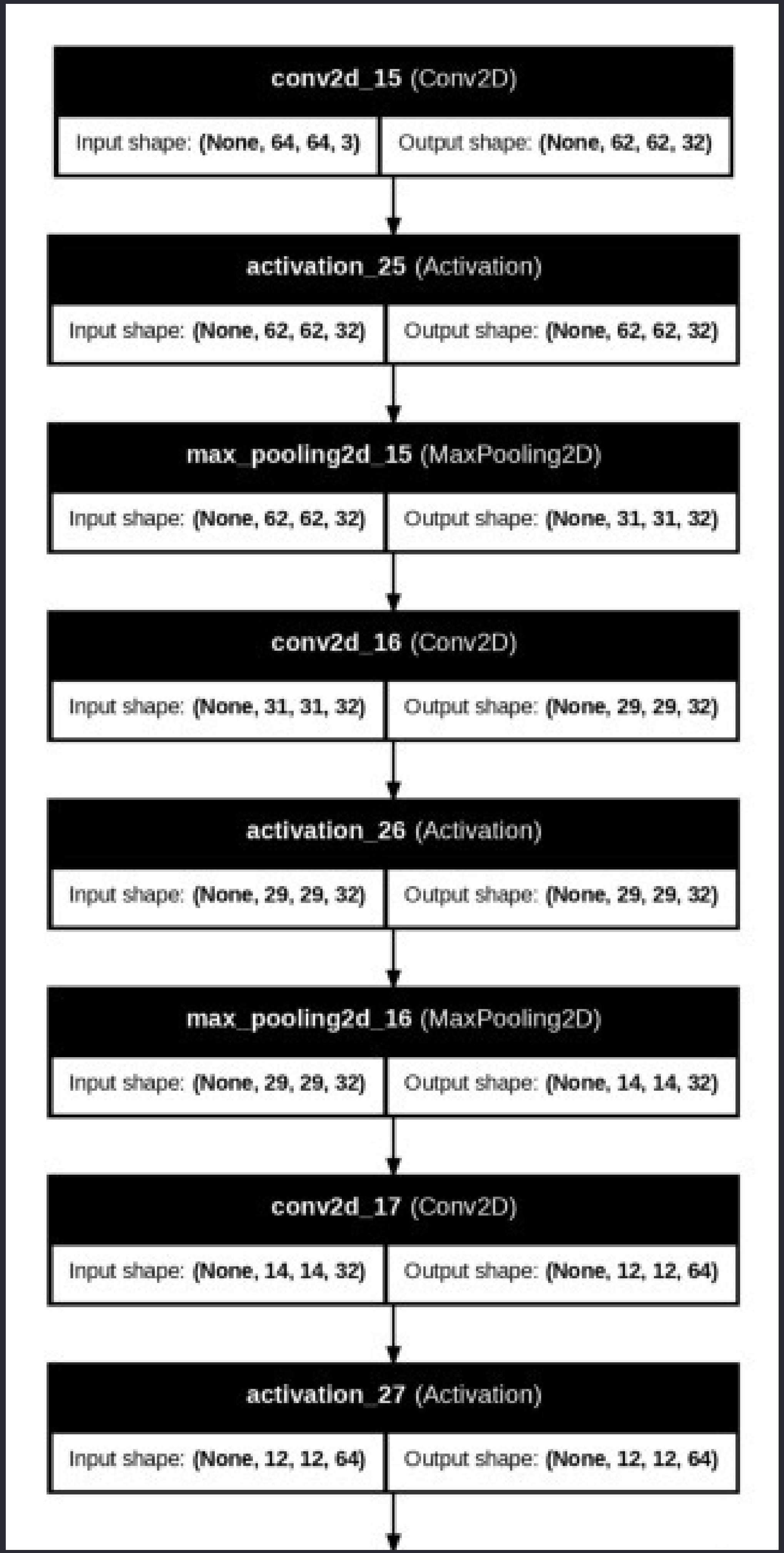
Dataset Acquisition

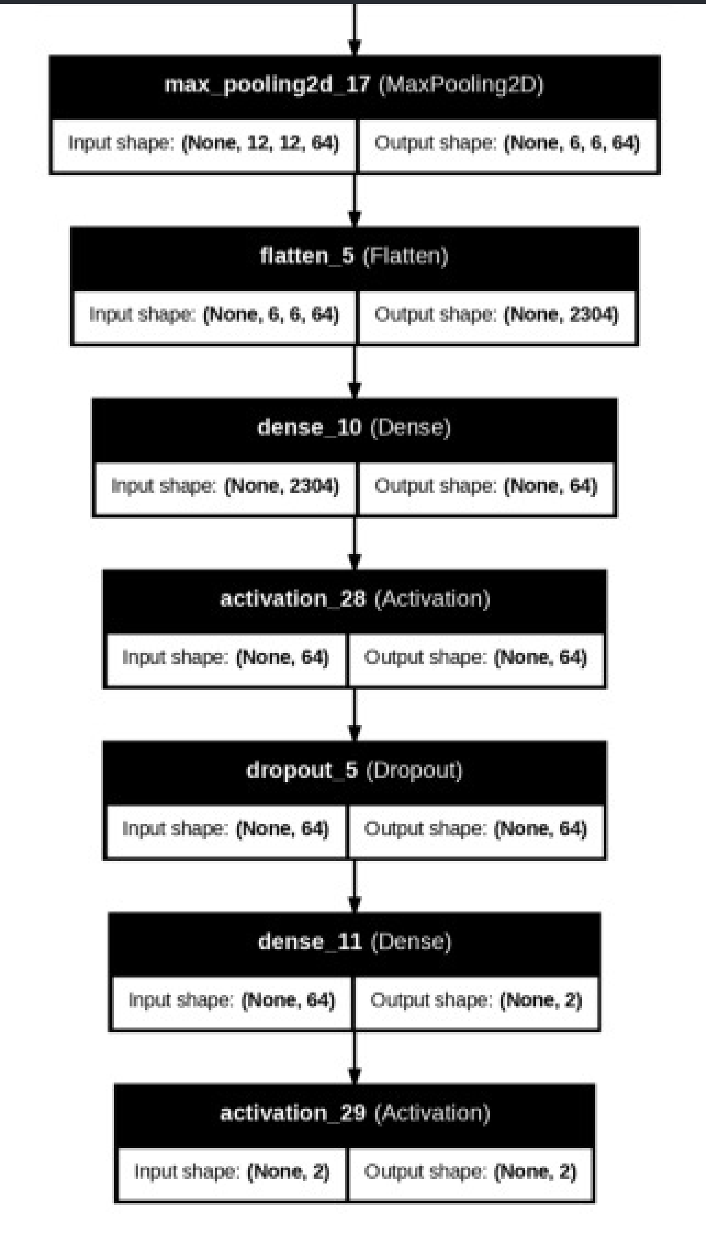
The used dataset has three folder:

- yes(for tumor) -1500 images-
- no(for normal) -1500 images-
- pred(for testing) -60 images-

Preprocessing Steps

- Visualize dataset images
- Put the labeling for the folders
- Image data processing (Resizing images to 64×64,and Normalization)
- applying one-hot encoding





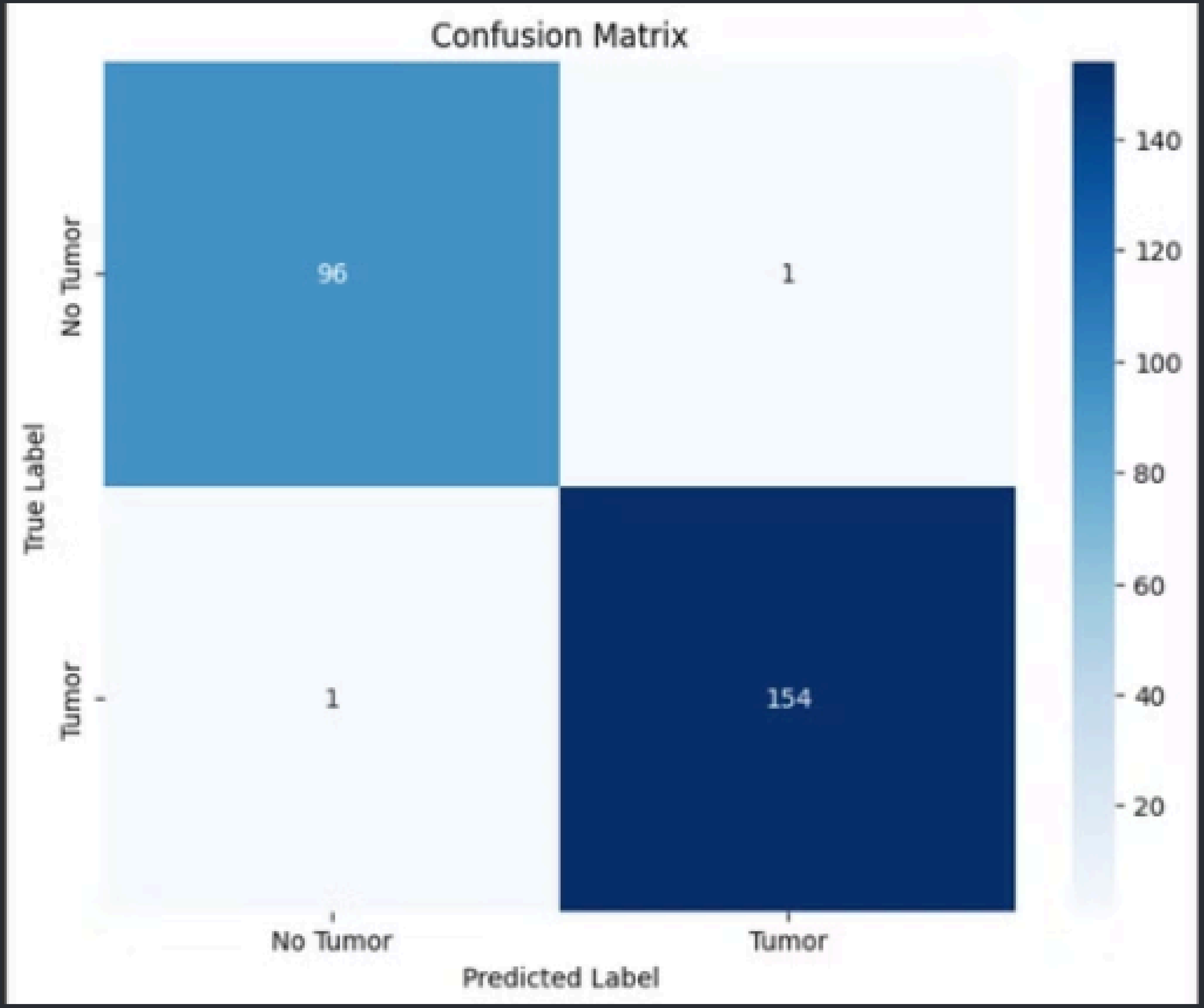
Model Development

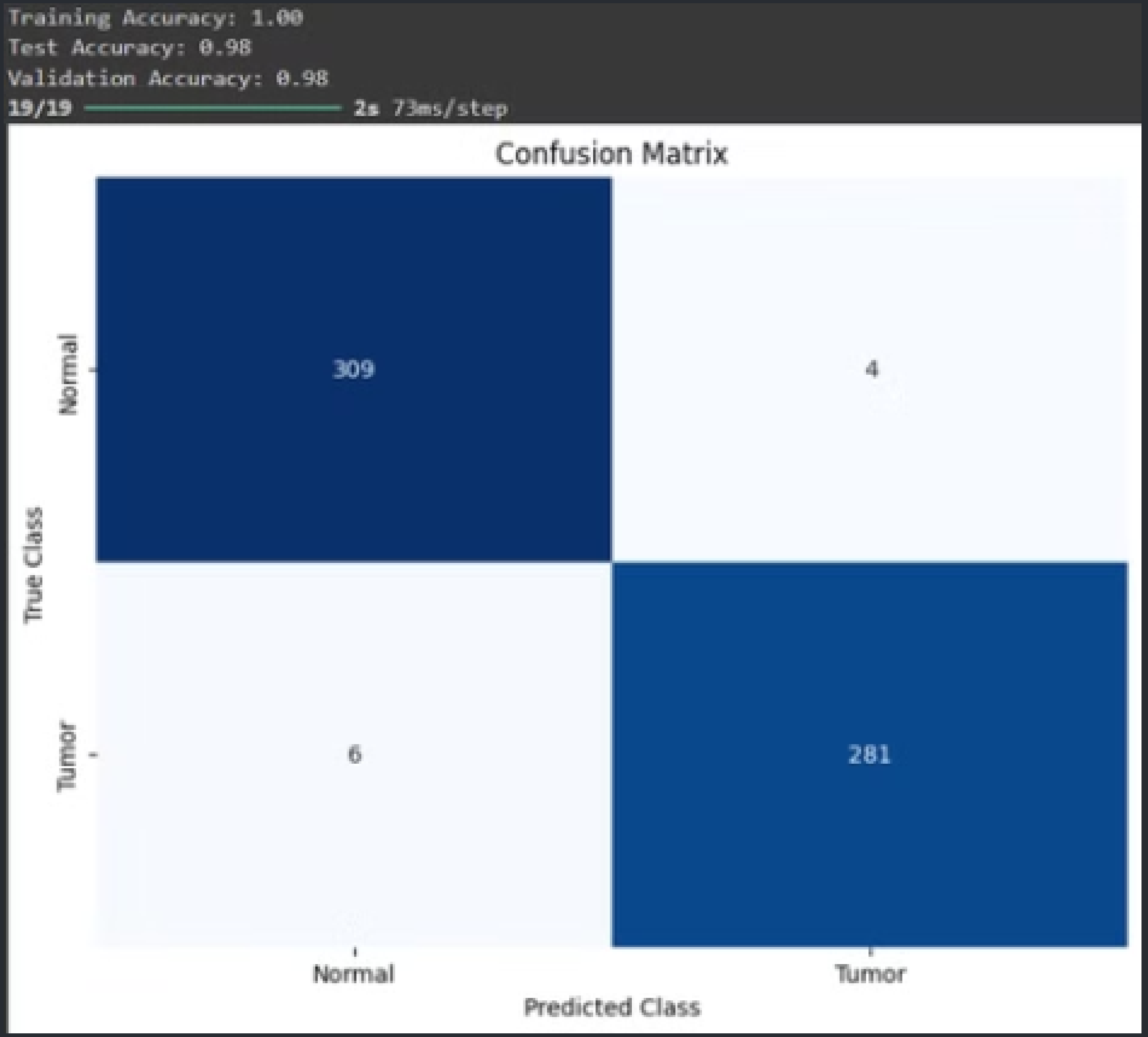
In our brain tumor detection project using MRI scans, we use Convolutional Neural Networks (CNNs), which are specialized algorithms for analyzing images, to classify them as normal or tumor. We start by gathering a balanced dataset and preprocessing the images to ensure consistency. After training the CNN on this data, we evaluate its performance on new images to help with early diagnosis and medical intervention..

Evaluation Metrics

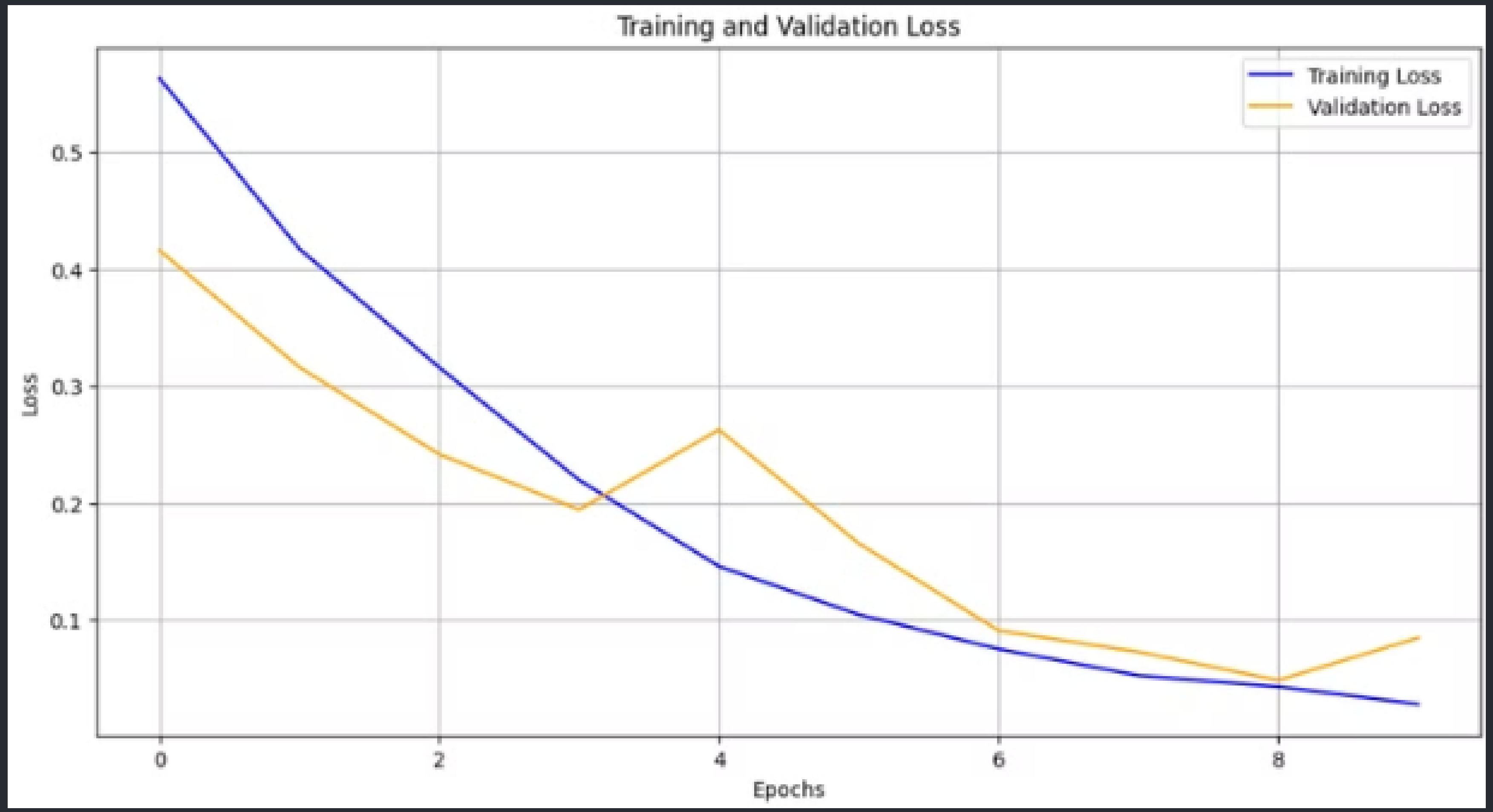
Metric	Description
Accuracy	Training Accuracy: 1.00 % Test Accuracy: 0.98 % Validation Accuracy: 0.98 %
confusion matrix	In our project, a confusion matrix helps evaluate the brain tumor detection model's performance by showing the counts of true positives, true negatives, false positives, and false negatives.

Confusion Matrix



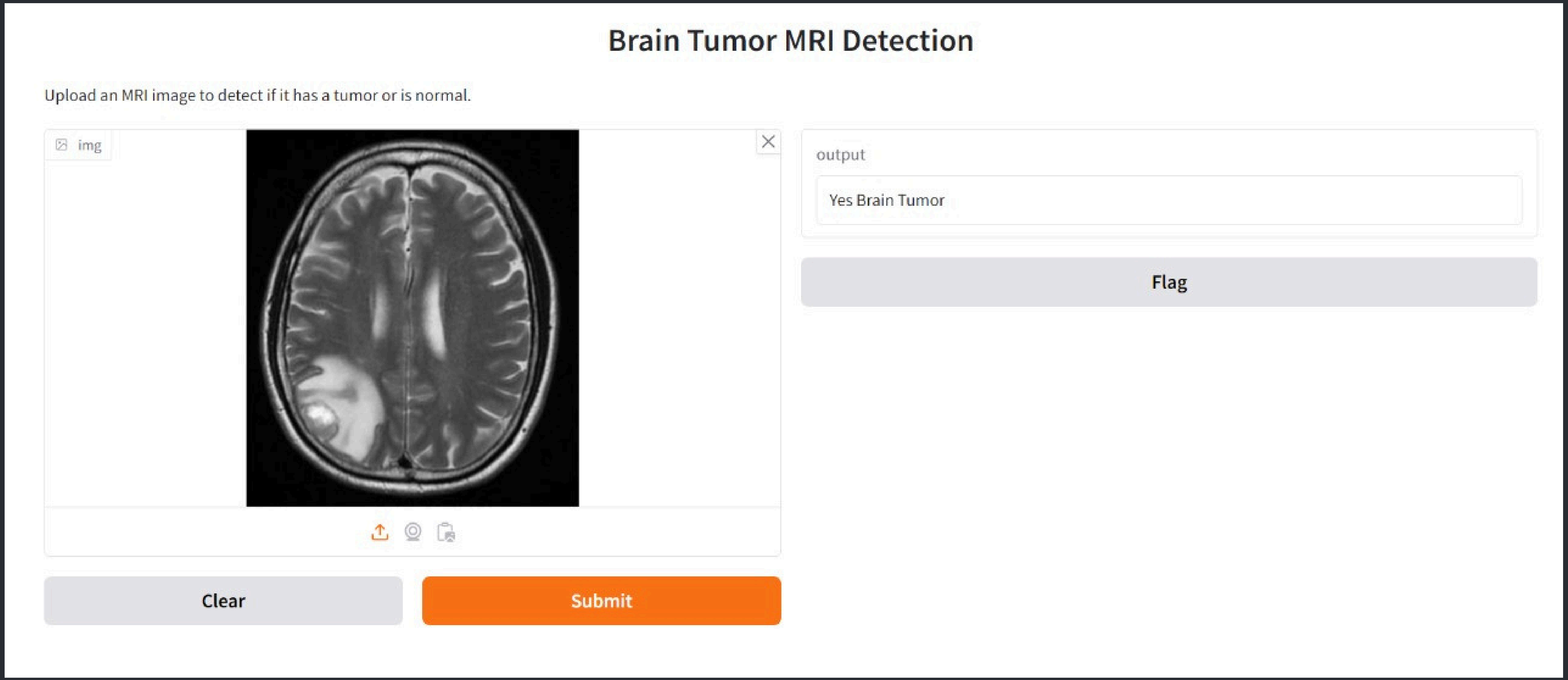


Graphs


Training and Validation Loss
Training Loss
Validation Loss
Loss
0.5
0.4
0.3
0.2
0.1
0
2
4
6
8
Epochs

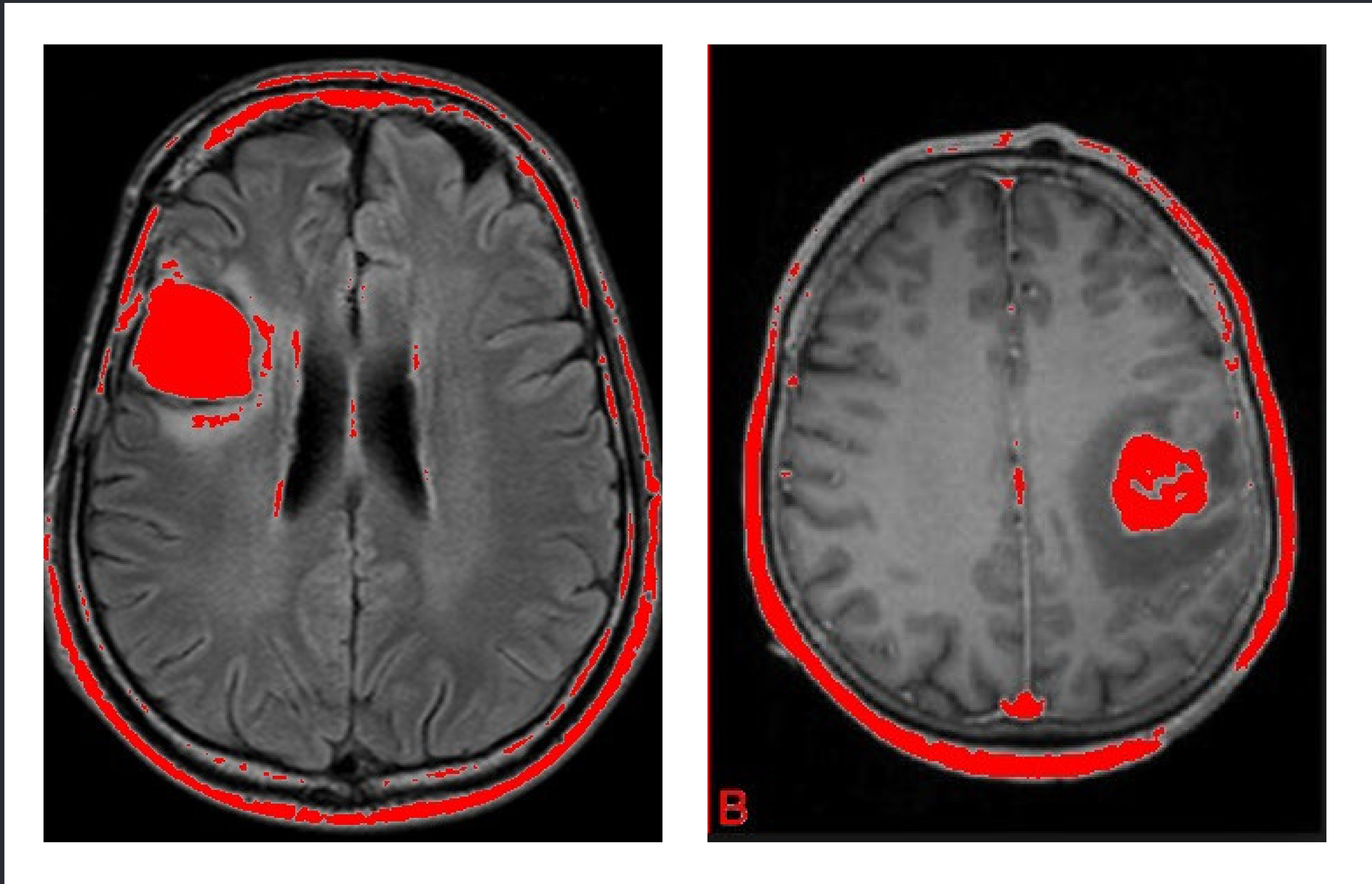

Training and Validation Accuracy
Training Accuracy
Validation Accuracy
Accuracy
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0
2
4
6
8
Epochs

Graphs


Brain Tumor MRI Detection
Upload an MRI image to detect if it has a tumor or is normal.
img
output
Yes Brain Tumor
Flag
Clear
Submit

Future Directions

segmentation



Thank You