# BRAIN TUMOR DETECTION

By

**Swapan Kumar Shee**

**(B.Tech 3rd Year CSE, Enrollment No.:12021002001009 )**

**Shivam Kumar Mishra**

**(B.Tech 3rd Year AIML, Enrollment No.:12021002001042 )**

**Under the Supervision of**

**Prof. Jyoti Khandelwal**

**Dept. of Computer Science & Engineering**

**University of Engineering & Management, Jaipur**

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# Introduction

- Brain MRI Images is helpful in brain tumor diagnosis process. Tumor and cancer is a harmful and death-defying disease for human life.
- In this study importance of the image classification in the world of the Biocomputing field explored.
- Image classification technique is efficiently improving the process of disease diagnosis. It is a process in which images are labeled into numerous predefined classes.
- Several techniques has been introduced for image classification like Logistic Regression, Random Forest, SVM,KNN and many others.
- In this study we proposed a model in which deep neural network technique is used with grey scaled segmentation technique. Combination of these two techniques is giving better result in minimum computational time.

# Literature Review

| Serial No. | Authors | Topic | Conclusion |
|---|---|---|---|
| 1. | Hemanth G, Janardhan M, Sujihelen L (2019) [1] | Design and implementing brain tumor detection using machine learning approach. | By utilizing the DM (data mining) techniques, significant relations and patterns from the data can be extracted. |
| 2. | Somasundaram S, Gobinath R (2019) [2] | Current trends on deep learning models for brain tumor segmentation and detection—a review. | 3D NN( Neural Network ) and Computational Machine learning that assists in processing the input images at multiple scales simultaneously. |

# Literature Review Cont...

| Serial No. | Author | Topic | Conclusion |
|---|---|---|---|
| 3. | Çınarer G, Emiroğlu BG (2019) [3] | Classification of brain tumors by machine learning algorithms. | SVM (support vector machines) algorithm with 90% accuracy rate was found to be better compared to other algorithms. |
| 4. | Wu W et al (2020) [4] | Intelligent diagnosis method of brain MRI tumor segmentation using deep convolutional neural network and SVM algorithm. | The performance of the proposed model is significantly better than the deep convolutional neural network and the integrated SVM classifier. |

# Objectives

- To accurately identify the presence and type of a tumor in the brain. This information is essential for developing an effective treatment plan.
- To Early detection of brain tumors is crucial, as malignant tumors can quickly grow and spread. By detecting tumors early, doctors can intervene with treatment before they cause significant damage to the brain.
- To detect brain tumors, including MRI scans, CT scans, and PET scans. These imaging techniques can provide detailed images of the brain, which can be used to identify tumors and other abnormalities.
- To Save patient's time and get timely consultation.

# Proposed Model

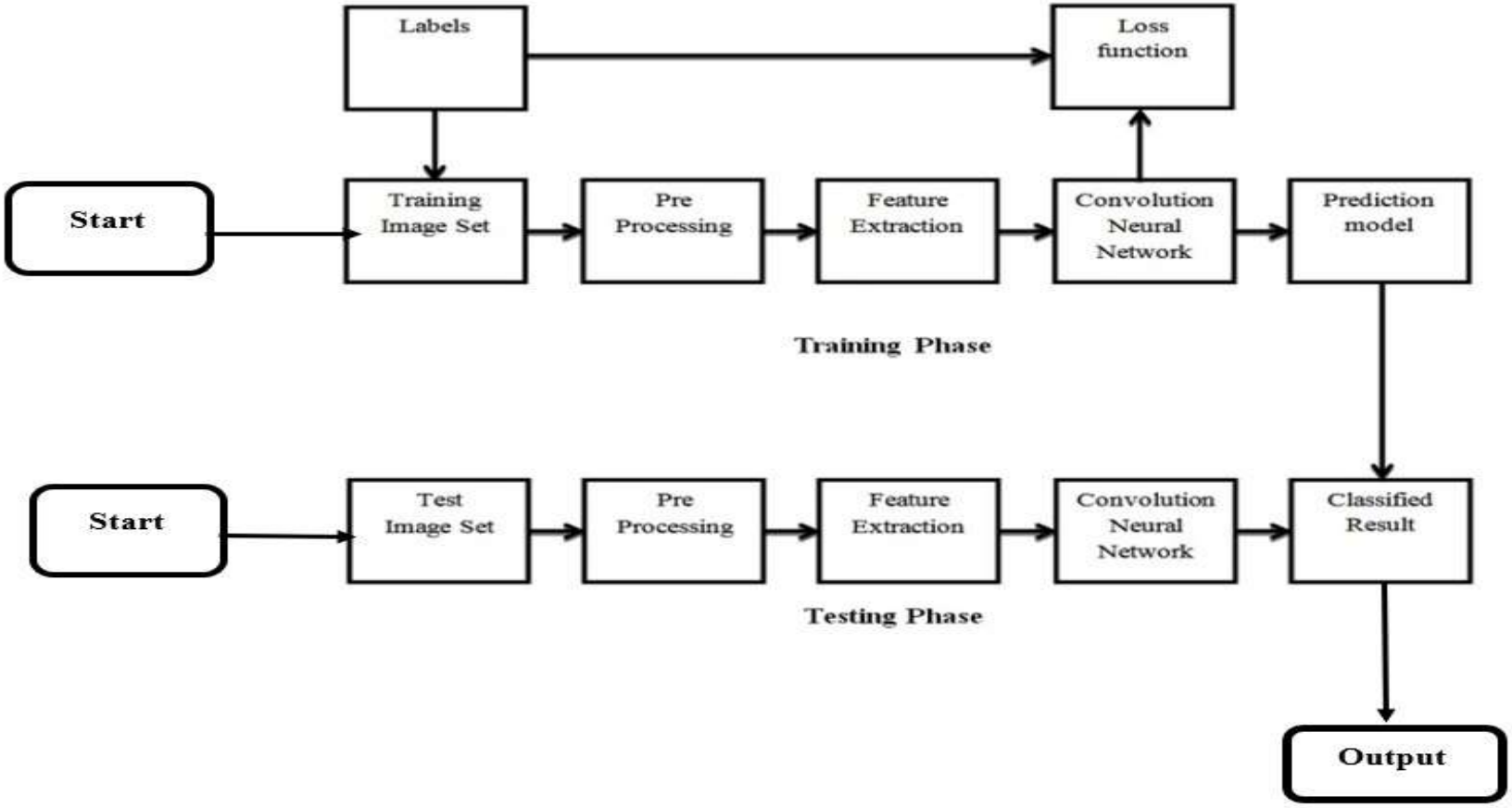



**Fig .1** Proposed model

# Experimental Set-up

| Software Requirements | Hardware Requirements |
|---|---|
| Operating system: Windows(10) or Linux or MAC | Processor: intel core i5 |
| Programming language: python | Hard disk:10 GB minimum |
| Editor and compiler(IDE): Juypter Notebook(6.5.3) | RAM:256 MB or more |

# Result

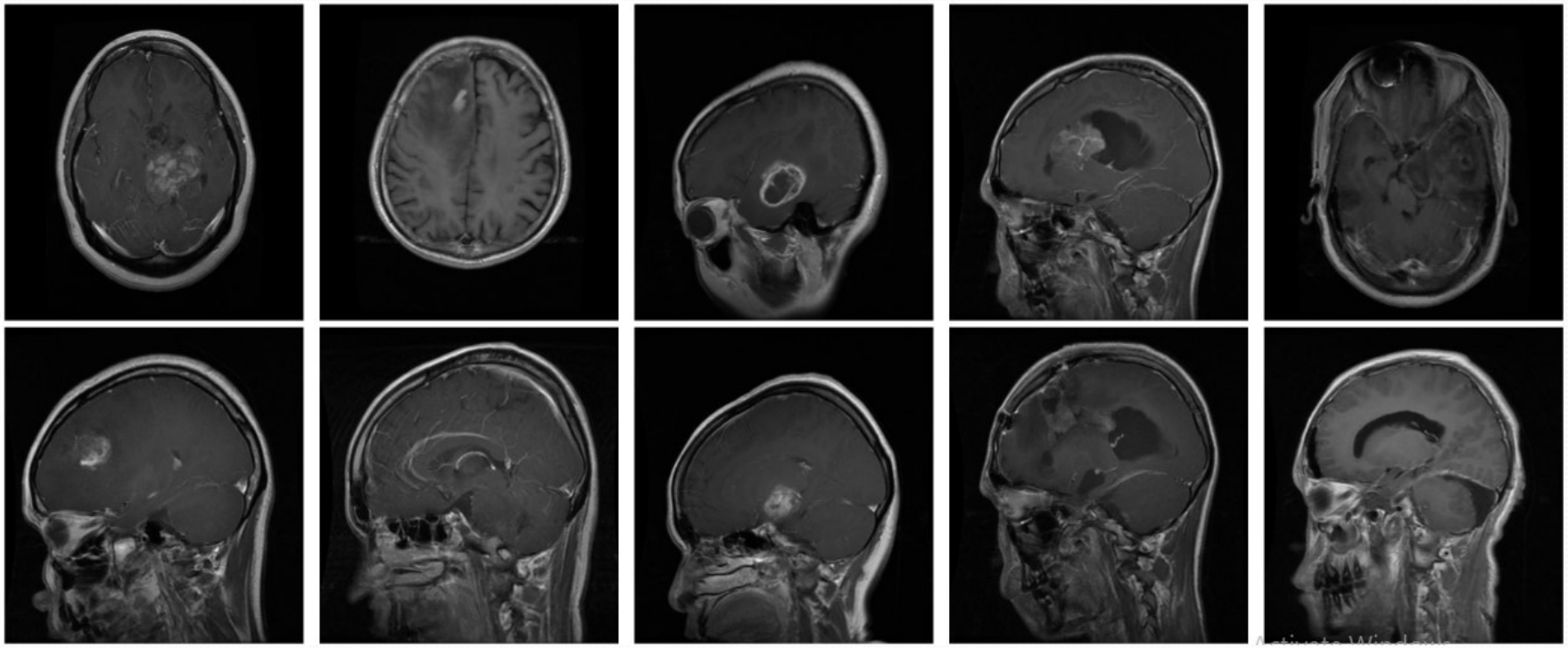
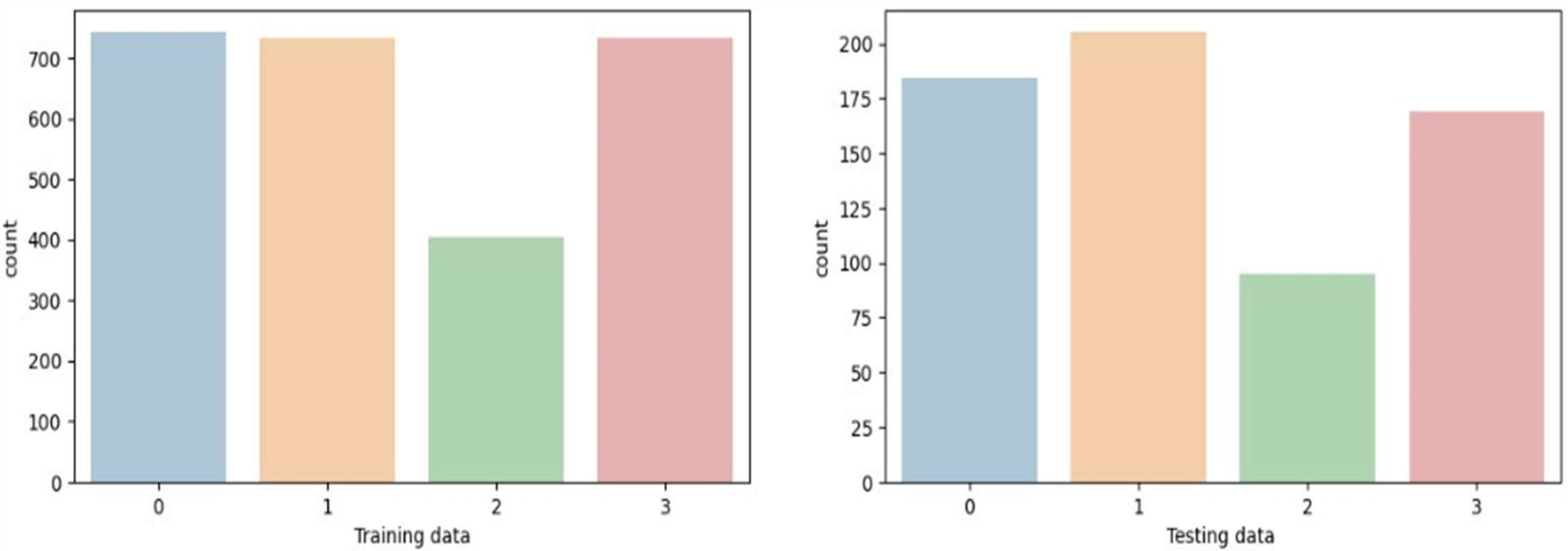


**Fig.2** Some sample MRI Images from Training Dataset

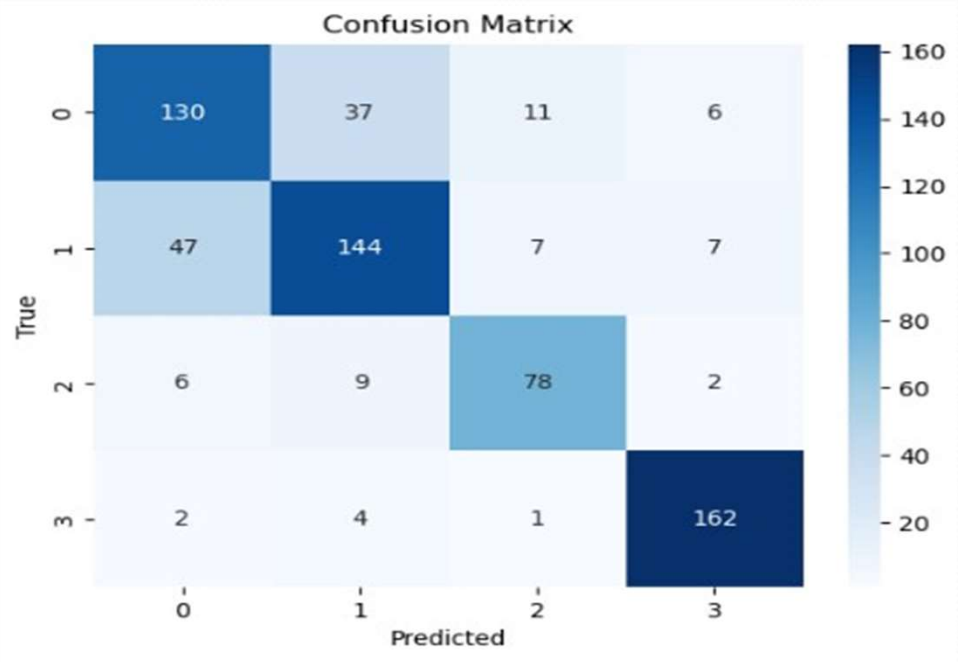
# Result Cont……




**(a)** **(b)**

**Fig.3** Data set partitions (a) Train Data; (b) Test Data

# Result Cont.....




(a)

Accuracy : 78.71362940275651 %

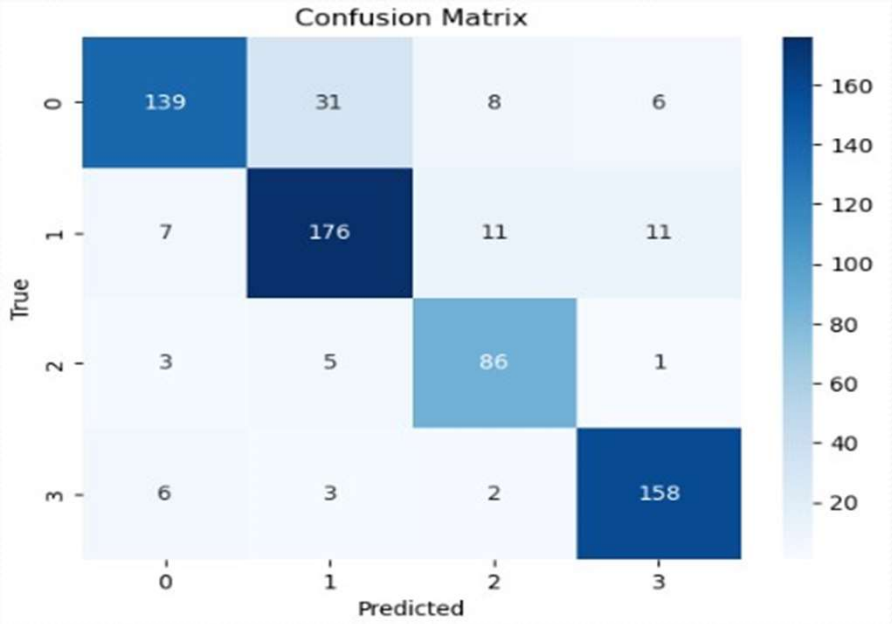
Classification Report is :

| | precision | recall | f1-score | support |
|---|---|---|---|---|
| 0 | 0.70 | 0.71 | 0.70 | 184 |
| 1 | 0.74 | 0.70 | 0.72 | 205 |
| 2 | 0.80 | 0.82 | 0.81 | 95 |
| 3 | 0.92 | 0.96 | 0.94 | 169 |
| accuracy | | | 0.79 | 653 |
| macro avg | 0.79 | 0.80 | 0.79 | 653 |
| weighted avg | 0.78 | 0.79 | 0.79 | 653 |

(b)

**Fig. 4** Logistic Regression results (a) Confusion matrix; (b) Classification report.

# Result Cont.....




**(a)**

Accuracy : 85.60490045941806 %

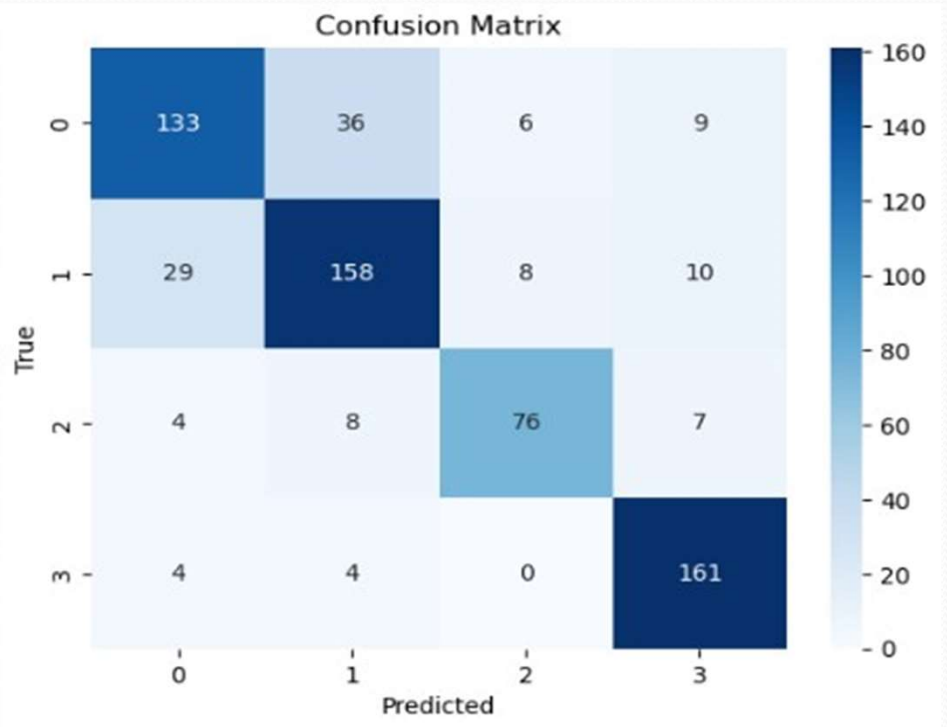
Classification Report is :

| | precision | recall | f1-score | support |
|---|---|---|---|---|
| 0 | 0.90 | 0.76 | 0.82 | 184 |
| 1 | 0.82 | 0.86 | 0.84 | 205 |
| 2 | 0.80 | 0.91 | 0.85 | 95 |
| 3 | 0.90 | 0.93 | 0.92 | 169 |
| accuracy | | | 0.86 | 653 |
| macro avg | 0.85 | 0.86 | 0.86 | 653 |
| weighted avg | 0.86 | 0.86 | 0.86 | 653 |

**(b)**

**Fig. 5** Random Forest results (a) Confusion martrix; (b) Classification report.

# Result Cont.....




(a)

Accuracy : 80.85758039816233 %

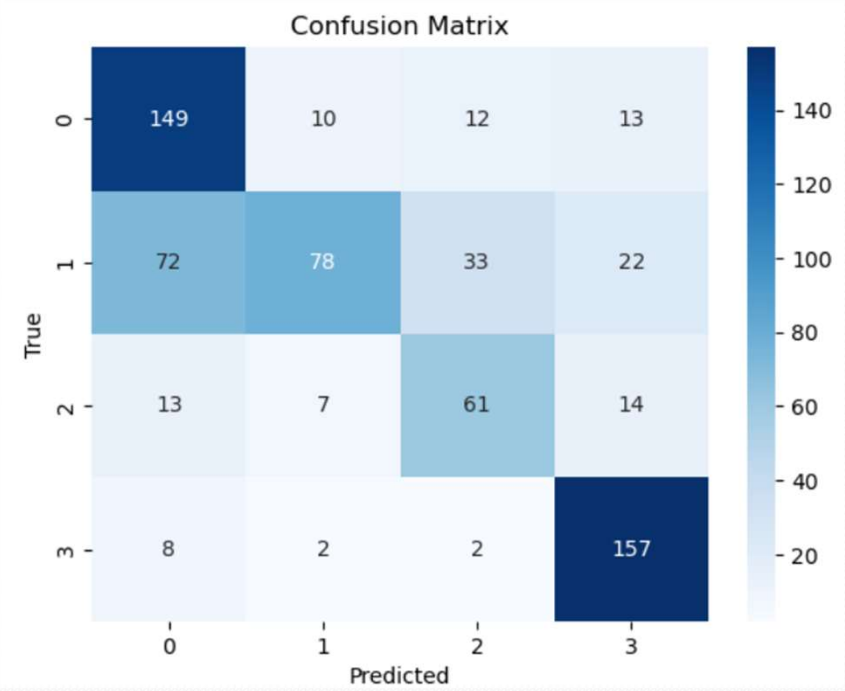
Classification Report is :

| | precision | recall | f1-score | support |
|---|---|---|---|---|
| 0 | 0.78 | 0.72 | 0.75 | 184 |
| 1 | 0.77 | 0.77 | 0.77 | 205 |
| 2 | 0.84 | 0.80 | 0.82 | 95 |
| 3 | 0.86 | 0.95 | 0.90 | 169 |
| accuracy | | | 0.81 | 653 |
| macro avg | 0.81 | 0.81 | 0.81 | 653 |
| weighted avg | 0.81 | 0.81 | 0.81 | 653 |

(b)

**Fig. 6** Support vector machine results (a) Confusion martrix; (b) Classification report.

# Result Cont.....




(a)

Accuracy : 68.1470137825421 %

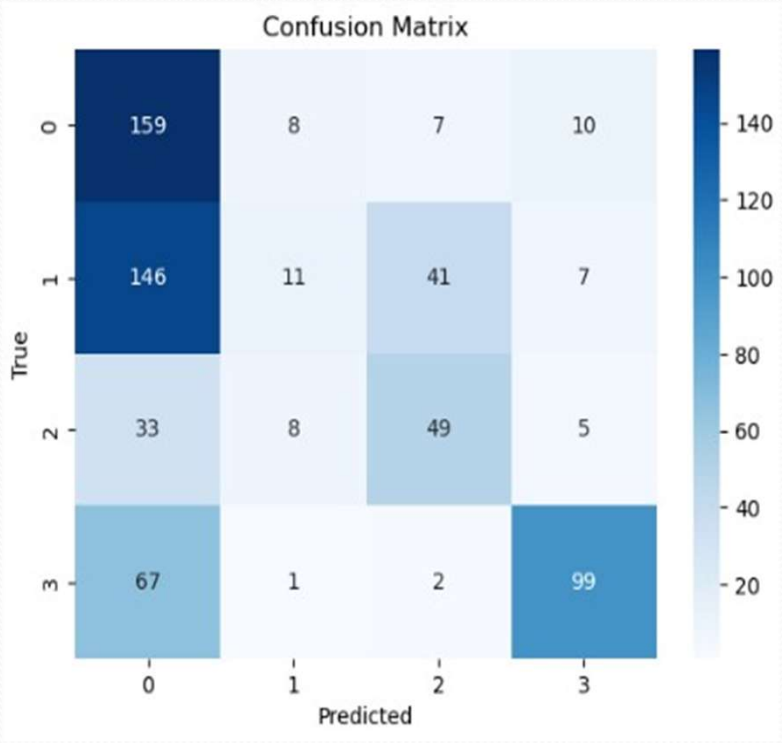
Classification Report is :

| | precision | recall | f1-score | support |
|---|---|---|---|---|
| 0 | 0.62 | 0.81 | 0.70 | 184 |
| 1 | 0.80 | 0.38 | 0.52 | 205 |
| 2 | 0.56 | 0.64 | 0.60 | 95 |
| 3 | 0.76 | 0.93 | 0.84 | 169 |
| accuracy | | | 0.68 | 653 |
| macro avg | 0.69 | 0.69 | 0.66 | 653 |
| weighted avg | 0.71 | 0.68 | 0.66 | 653 |

(b)

**Fig. 7** KNN Classifier results (a) Confusion martrix; (b) Classification report.

# Result Cont.....




(a)

Accuracy : 48.69831546707503 4 %

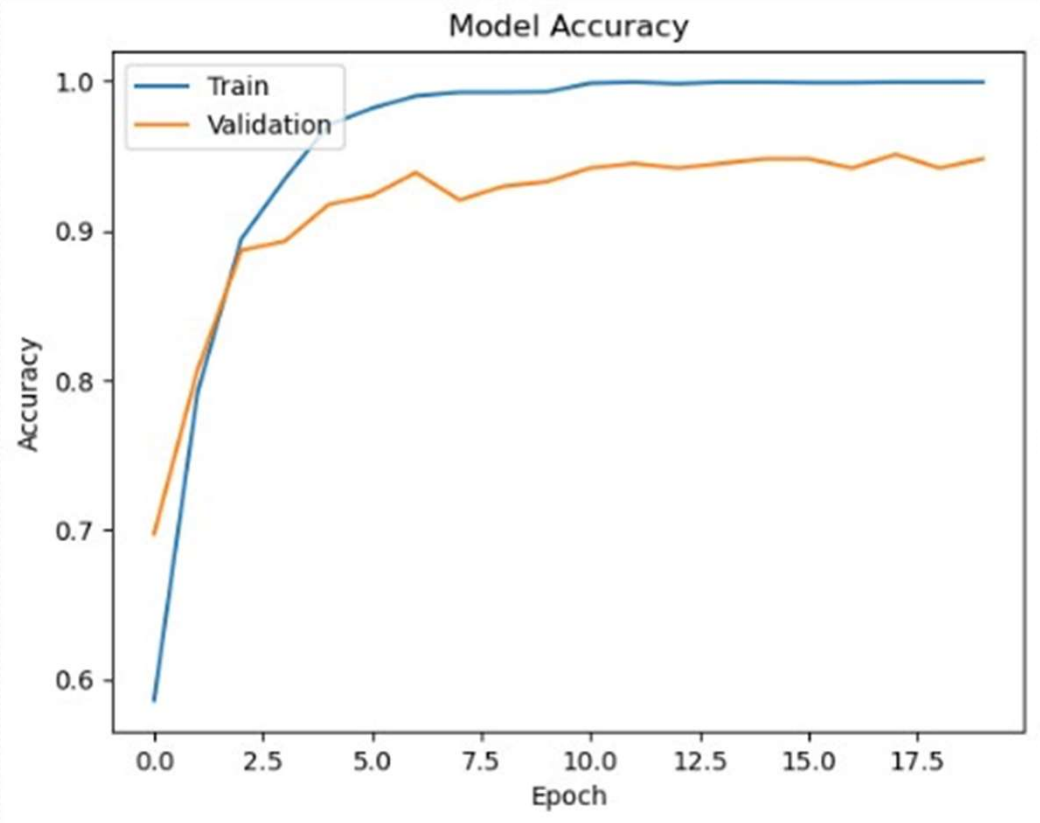
Classification Report is :

| | precision | recall | f1-score | support |
|---|---|---|---|---|
| 0 | 0.39 | 0.86 | 0.54 | 184 |
| 1 | 0.39 | 0.05 | 0.09 | 205 |
| 2 | 0.49 | 0.52 | 0.51 | 95 |
| 3 | 0.82 | 0.59 | 0.68 | 169 |
| accuracy | | | 0.49 | 653 |
| macro avg | 0.52 | 0.50 | 0.46 | 653 |
| weighted avg | 0.52 | 0.49 | 0.43 | 653 |

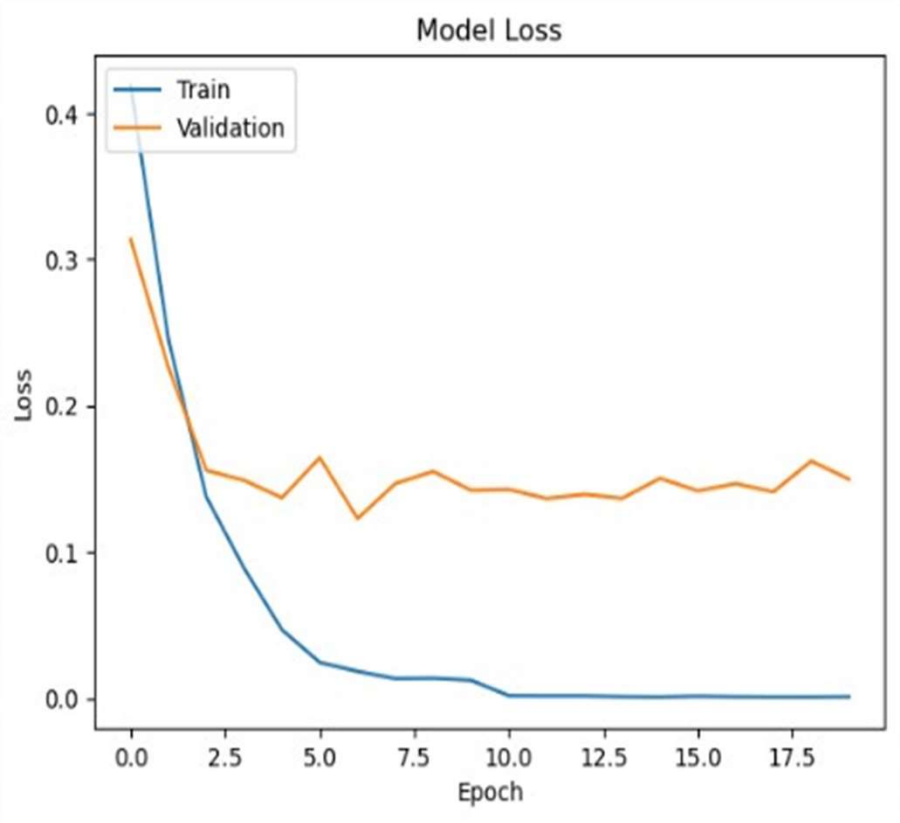
(b)

**Fig. 8** Naive bayes results (a) Confusion martrix; (b) Classification report.

# Result Cont.....



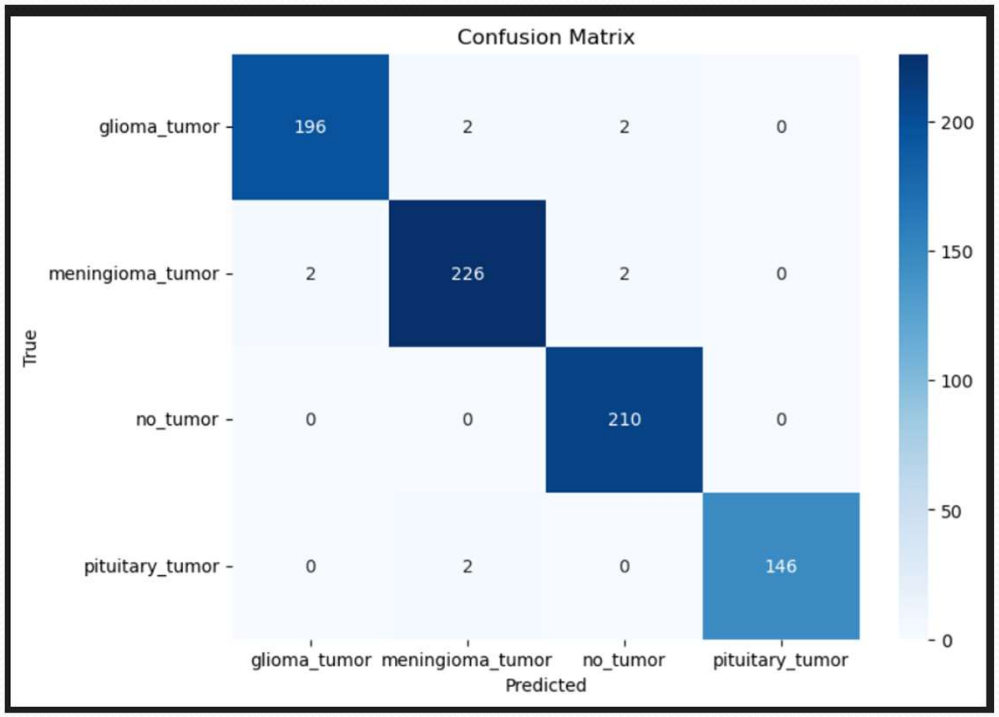

(a)




(b)

**Fig.10** Training and Validation Model results (a) Accuracy of CNN; (b) Loss of CNN

# Result Cont.....




(a)

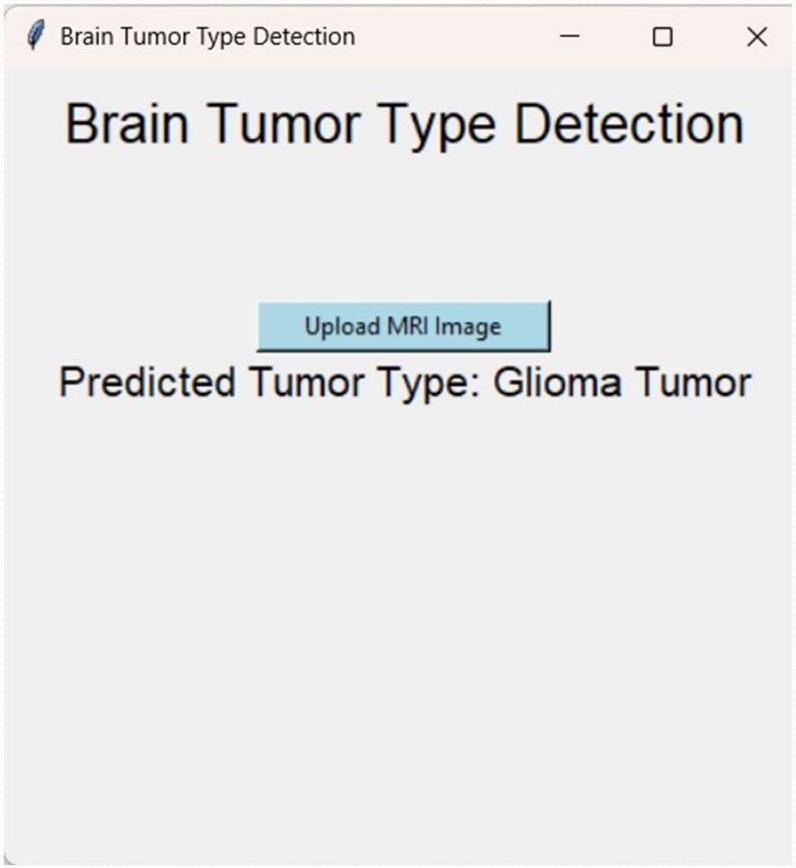
Classification Report:

| | precision | recall | f1-score | support |
|---|---|---|---|---|
| glioma_tumor | 0.99 | 0.98 | 0.98 | 200 |
| meningioma_tumor | 0.98 | 0.98 | 0.98 | 230 |
| no_tumor | 0.98 | 1.00 | 0.99 | 210 |
| pituitary_tumor | 1.00 | 0.99 | 0.99 | 148 |
| accuracy | | | 0.99 | 788 |
| macro avg | 0.99 | 0.99 | 0.99 | 788 |
| weighted avg | 0.99 | 0.99 | 0.99 | 788 |

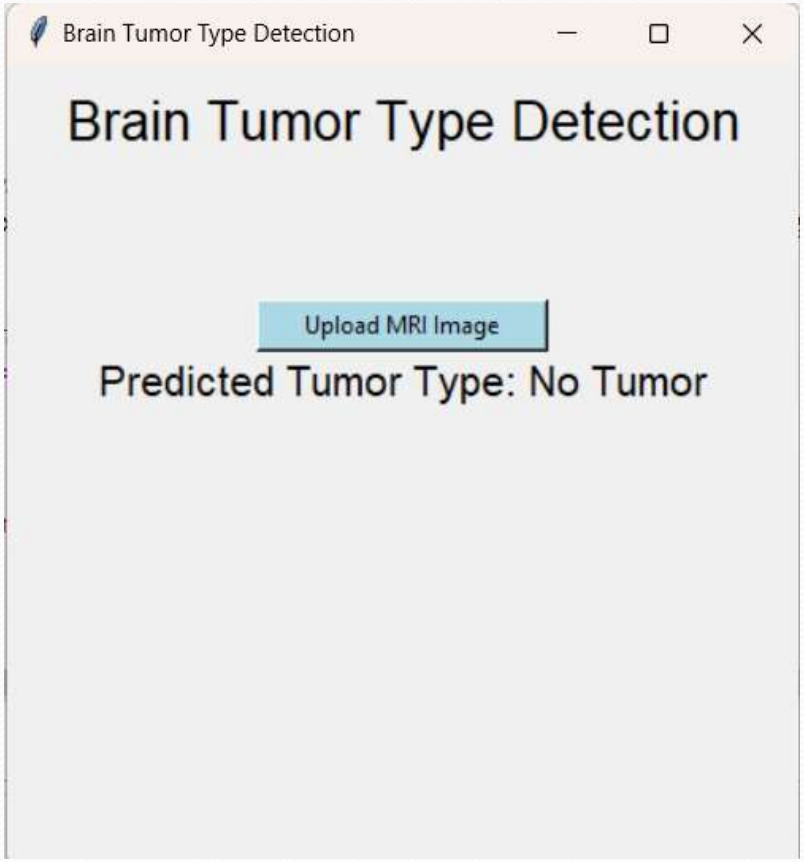
(b)

**Fig.9** CNN Results (a) Confusion Matrix; (b) Classification Report

# Result Cont....




(a)




(b)

**Fig.11** (a)Test1; (b)Test2

# Result Analysis

- This proposed brain tumor detection model achieved an **accuracy of 98.73%**, on a **Test Dataset of 394**. This indicates that the model is able to accurately detect brain tumors. The **high sensitivity** of the model suggests that it is able to correctly identify most brain tumors, while the **high specificity** suggests that it is able to correctly identify most non-tumorous cases.
- Kaggle data set: - https://www.kaggle.com/datasets/sartajbhuvaji/brain-tumor-classification-mri
- The results of this study suggest that the proposed brain tumor detection model is a **promising tool** for the diagnosis of brain tumors. The model is able to **accurately detect** brain tumors in most cases, and it is also able to perform well on challenging cases.
- The GUI provided a **user-friendly interface** for individuals to interact with the model, making predictions on new MRI images without the need to run the entire script.

# Conclusions & Future Scope

- Our project achieved success in implementing a robust CNN for brain tumor classification in MRI scans, demonstrating promising performance.
- Acknowledging limitations like dataset size and interpretability issues, the project sets the stage for future enhancements in this critical medical field.
- Build an app-based user interface in hospitals which allows doctors to easily determine the impact of tumor and suggest treatment accordingly.
- Collaborating with healthcare institutions for extensive clinical validation will validate the model's efficacy in real-world scenarios, ensuring its practical utility and compliance with medical standards.

# References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