

NeuroDetect

Brain Tumour Detection System

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Refresher



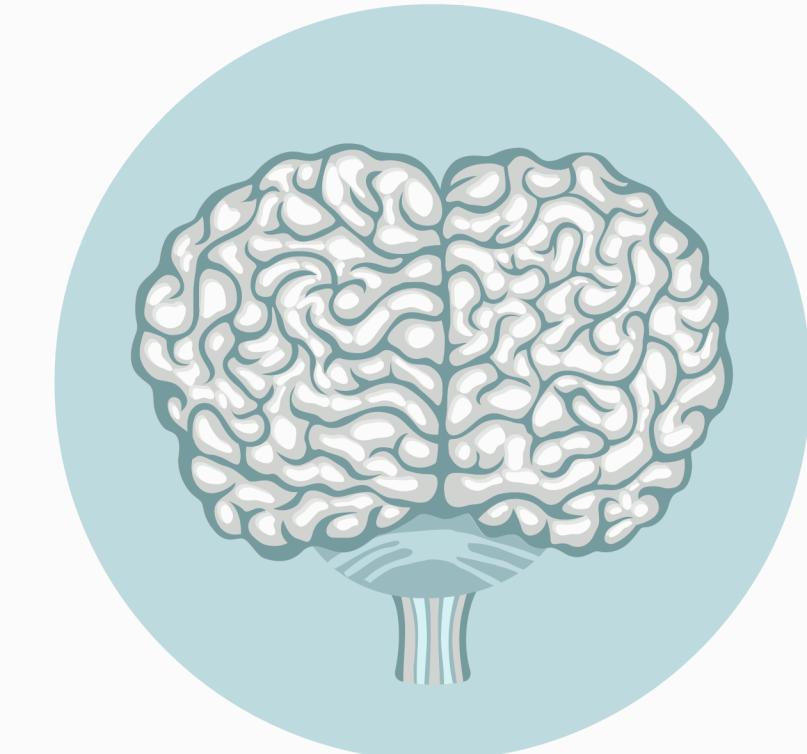
Background

Brain tumours are challenging to detect in the early stages. Early detection is crucial, helping medical professionals select effective treatment options and saving lives.



Importance

Using machine learning, how can we identify tumours in MRI scans to improve early detection, prevent further complications, and accelerate treatment planning?



MRI Scans

Dataset contains 7023 MRI images of brain tumours classified into 4 groups:

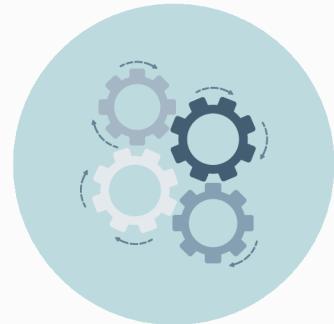
- Glioma
- Meningioma
- Pituitary
- Non Tumour



Data Source

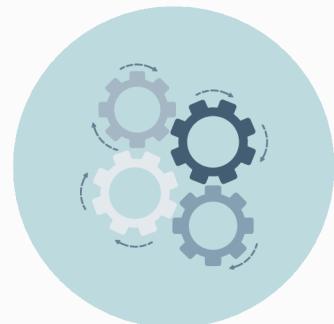
Dataset is a combination of three datasets, which were combined and collected from Kaggle.

Baseline Model



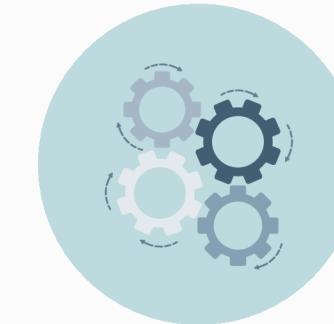
Logistic Regression

Standard logistic regression model used for simple classification. A good start for any classification problem.



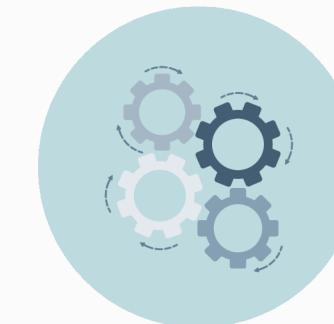
Random Forest

Mainly to demonstrate how multiple decision tree model works on image classification. Examine how model may choosing the best path amidst multiple options.



Support Vector Machine (SVM)

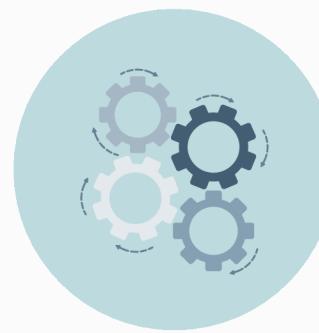
Supervised learning model to solve complex problems. Performs outlier detection problems and boundaries between data points.



Convolutional Neural Network (CNN)

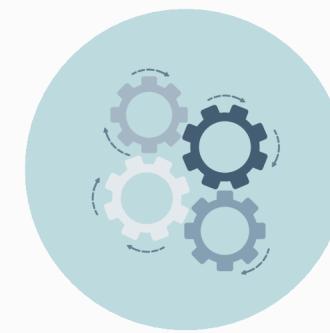
The standard model when it comes to any image classification problems. A very simple CNN model was created (4 layers max) to make it a fair comparison with the other models.

Advance Model



Convolutional Neural Network (CNN)

The standard model when it comes to any image classification problems. A more advance CNN model was created and tuned to make the model better. Contains 14 layers.



Transfer Learning (ResNet50)

Leveraging a prebuilt CNN model, in this case ResNet-50 network, and building on top of it. Goal is to see if it performs better then a model curated for brain images.

Model Accuracy

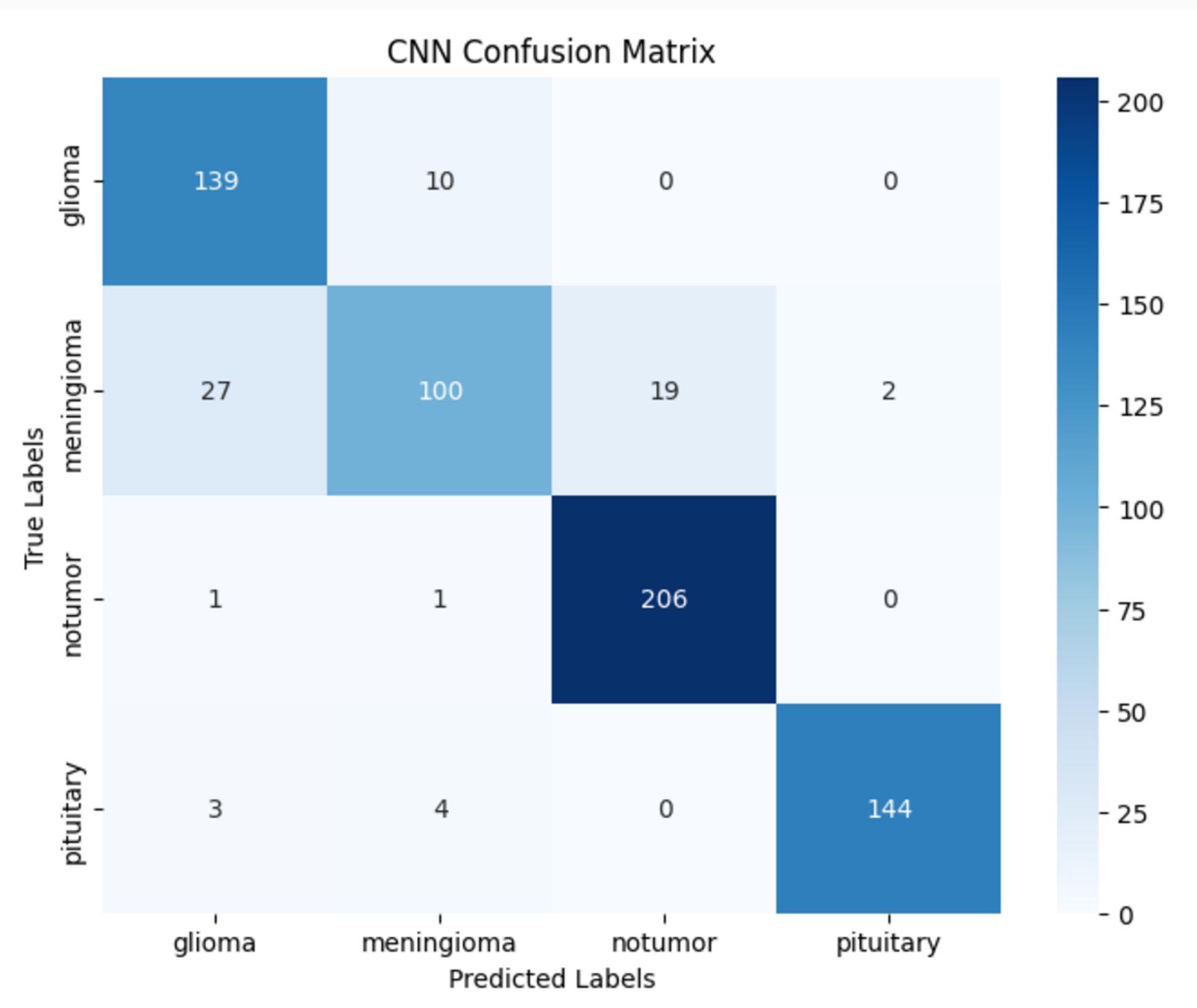
| | Train Accuracy | Test Accuracy |
|------------------------------|----------------|---------------|
| Logistic Regression | 89.74% | 81.46% |
| Support Vector Machine (SVM) | 92.49% | 88.33% |
| Random Forest | 83.96% | 75.97% |
| CNN Baseline Model | 95.95% | 90.69% |
| CNN Advance Model | 98.76% | 96.49% |
| ResNet50 Model | 92.66% | 91.62% |

Baseline Model Recall Score

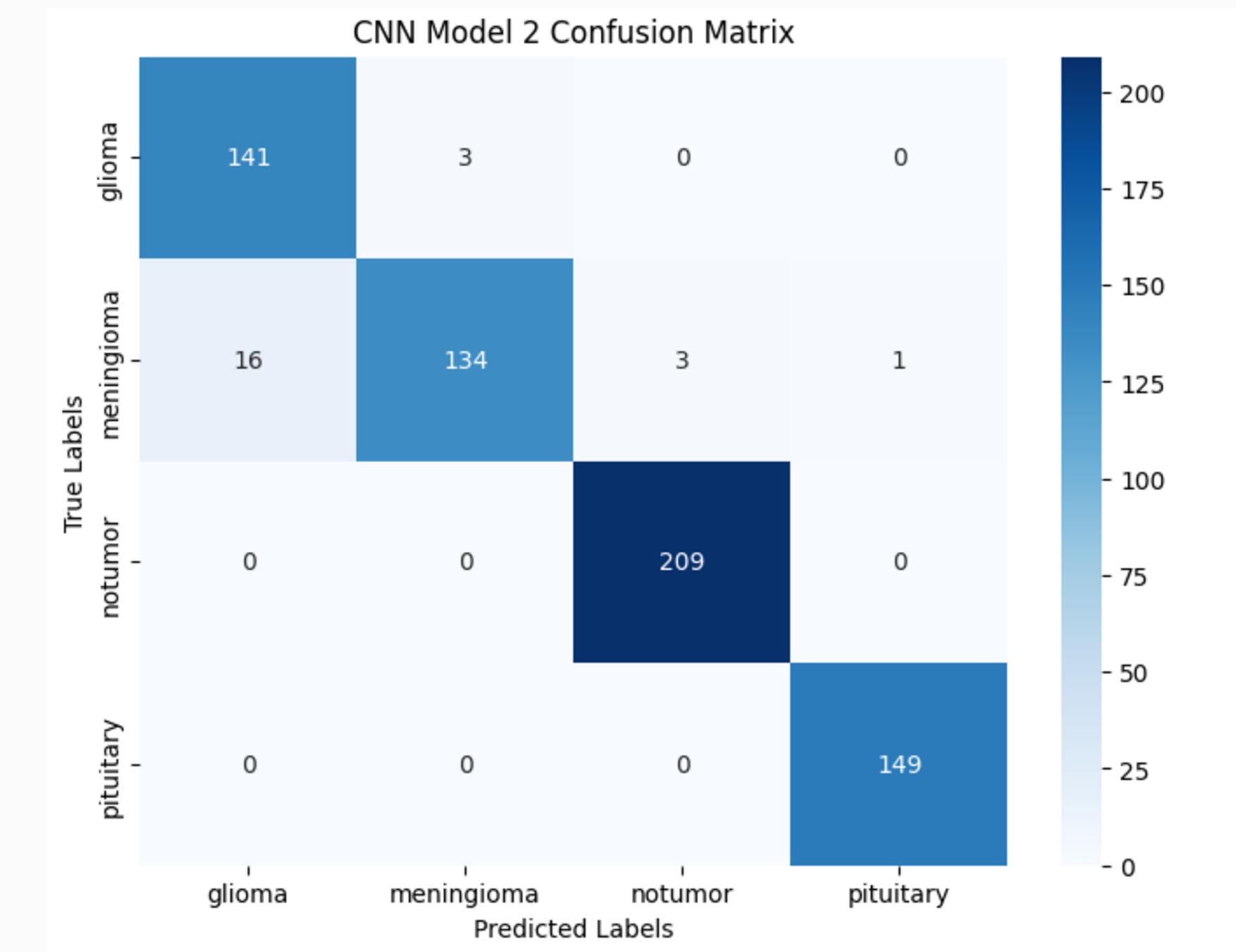
| | No Tumor Recall | Pituitary Recall | Glioma Recall | Meningioma Recall |
|---------------------------------|--------------------|------------------|---------------|----------------------|
| Logistic Regression | 95% | 95% | 71% | 61% |
| Support Vector Machine (SVM) | 97% | 97% | 82% | 75% |
| Random Forest | 93% | 92% | 63% | 51% |
| CNN Base Model | 99% | 95% | 93% | 68% |
| CNN Advance Model | 99% | 99% | 98% | 87% |
| ResNet50 | 100% | 96% | 81% | 86% |

Confusion Matrix

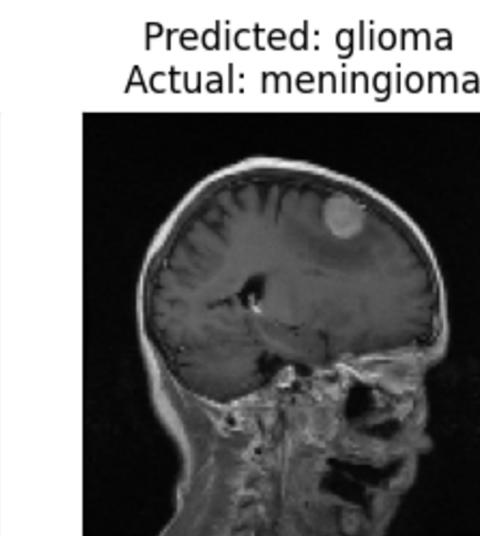
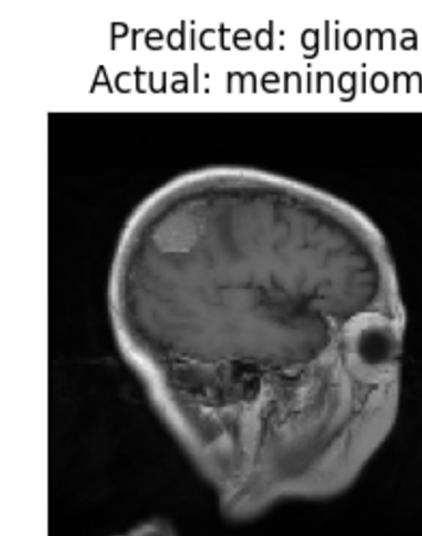
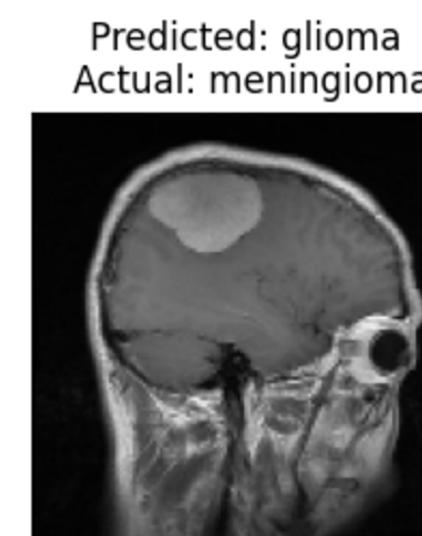
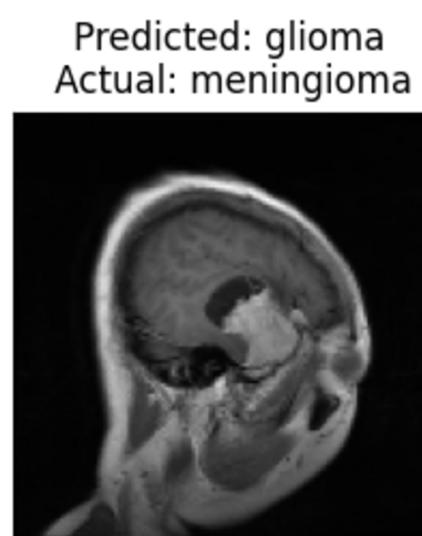
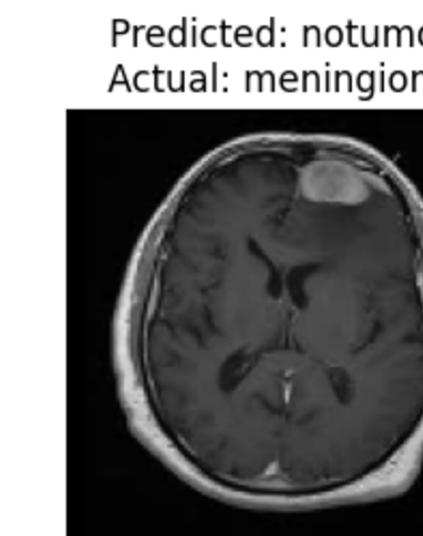
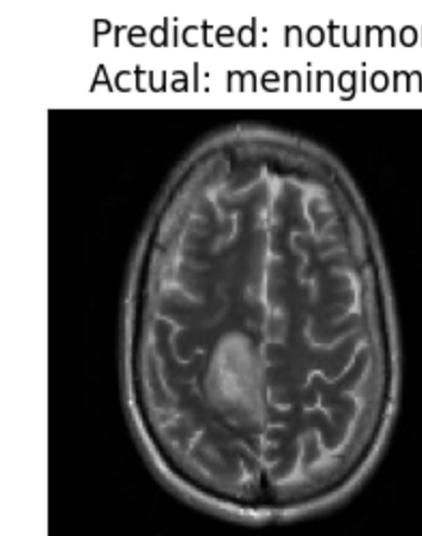
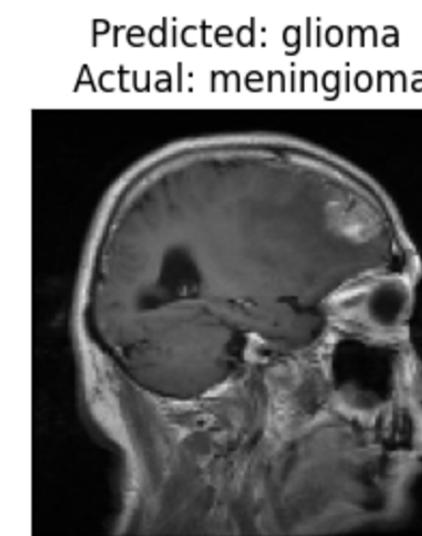
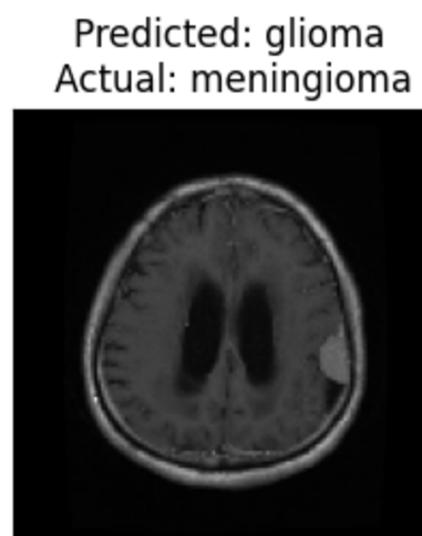
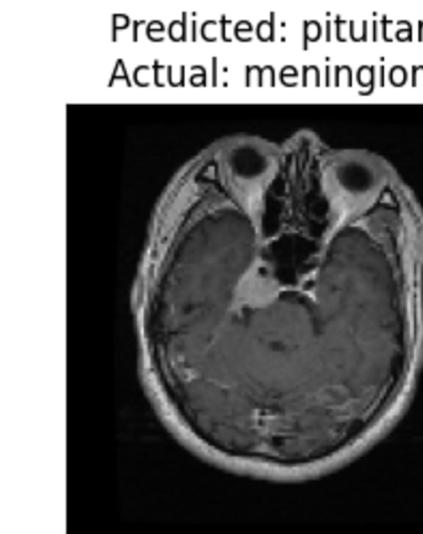
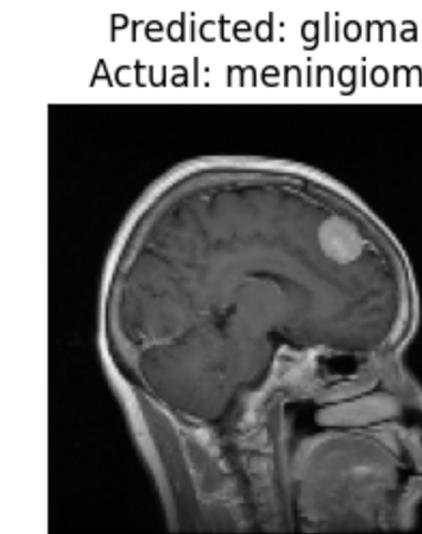
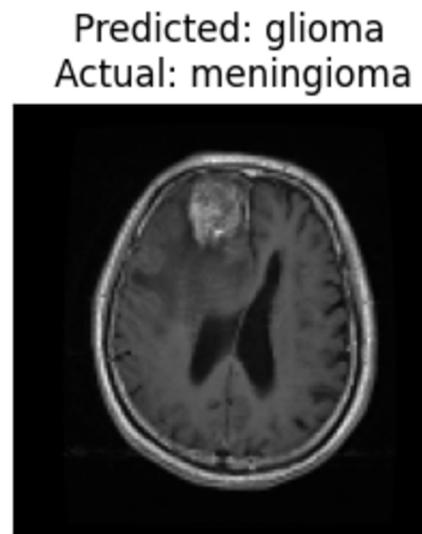
CNN Baseline Model



CNN Advance Model

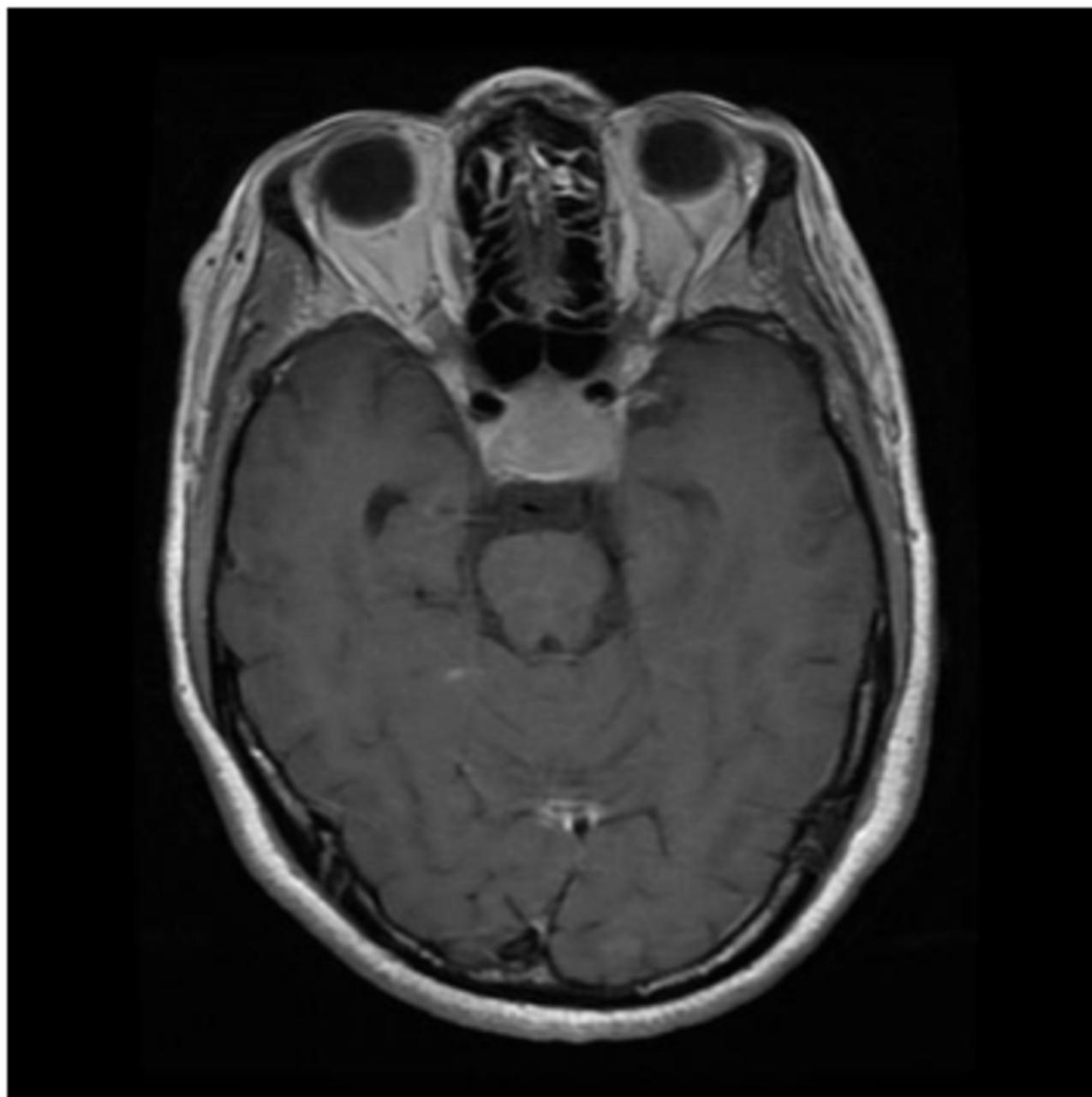


Incorrect Classifications

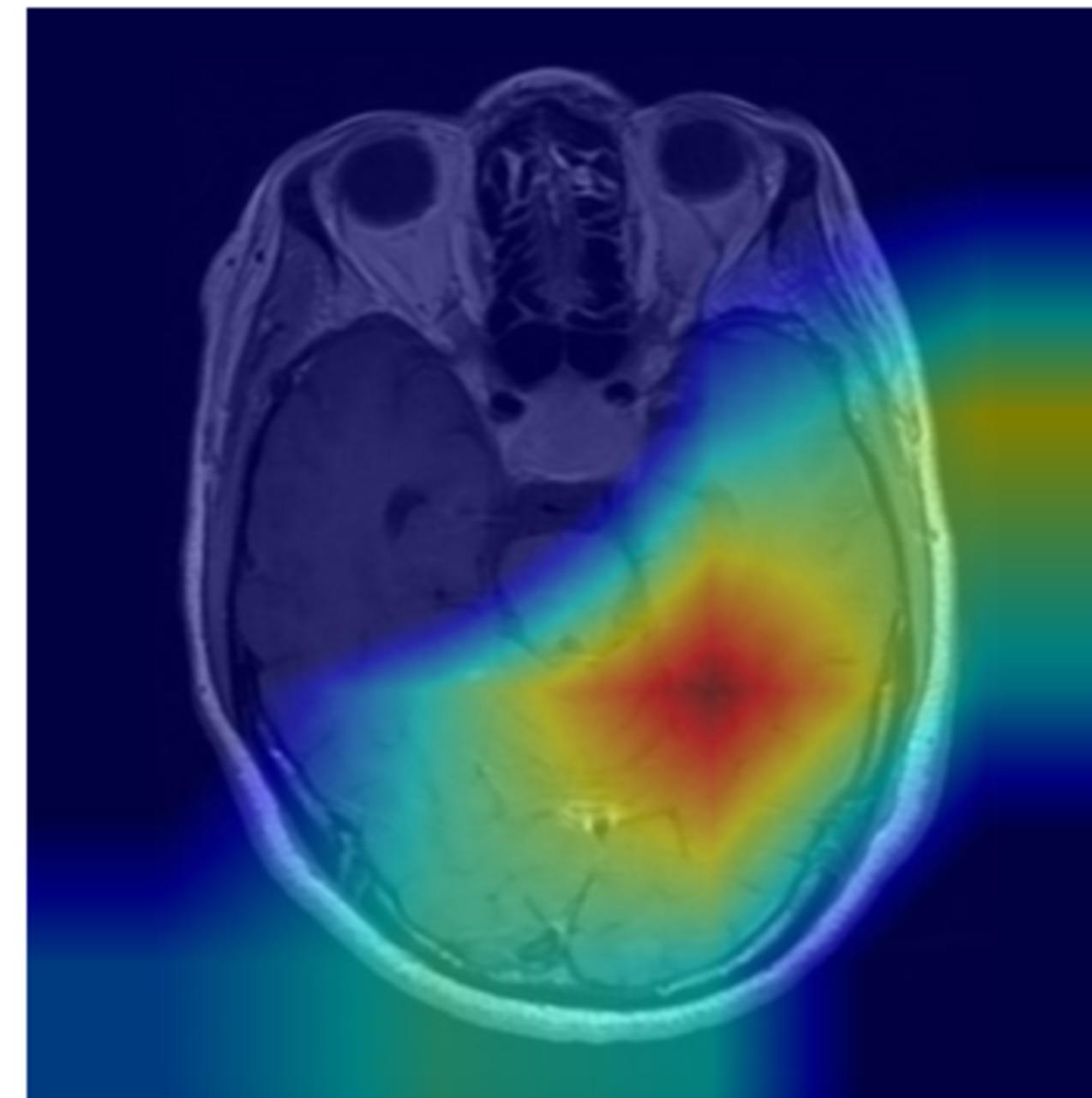


Predicted Meningioma Image

Original Pituitary Image



Heatmap Overlay



Conclusion

Conclusion:

- After experimenting with different models, we were able to fine-tune and identify the best-performing one.
- Model performance was evaluated based on key metrics such as accuracy, and recall.
- Model ready for deployment for medical professionals such as radiologist.

Results:

- CNN Advance Model performed the best overall (over 87% recall rate for all classification group)
- Test accuracy of 96.49%

Production:

- Productionalize our model by saving the best model, create an API using Flask, containerize using Docker and deploying it to the cloud such as AWS



Thank You

Do you have any questions?



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