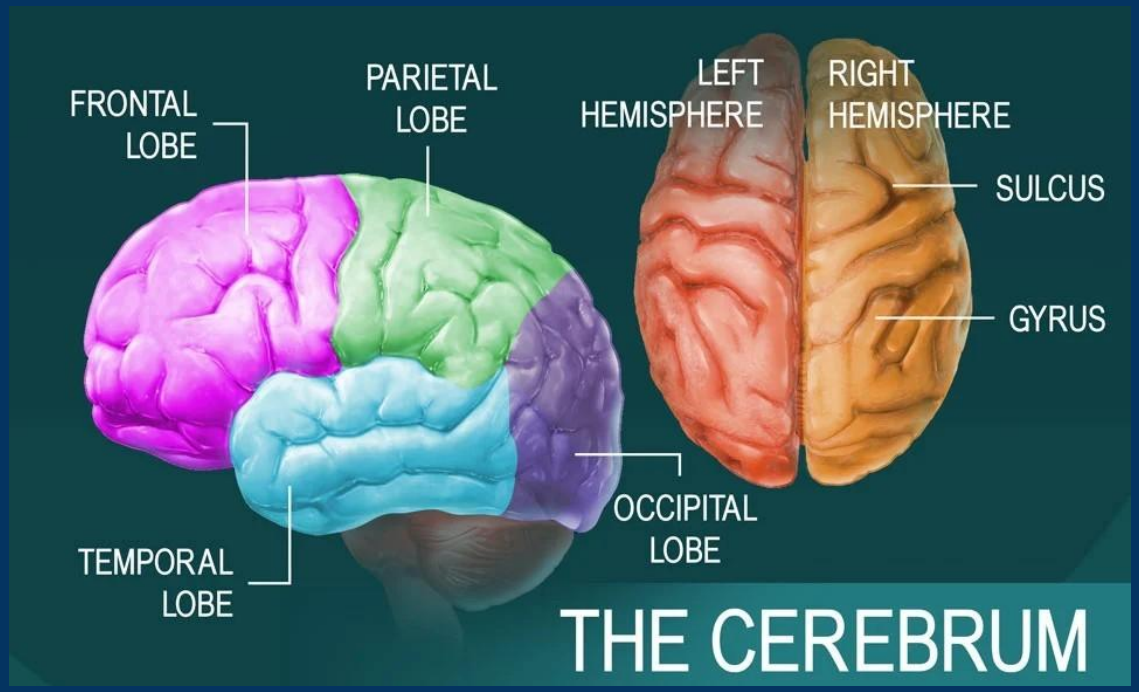


AI Boot Camp **Final Project**

Brain MRI CNN

Team Members:

Ryan Brunelle

Louis Ray

Bernadette DeLuca

Project Purpose

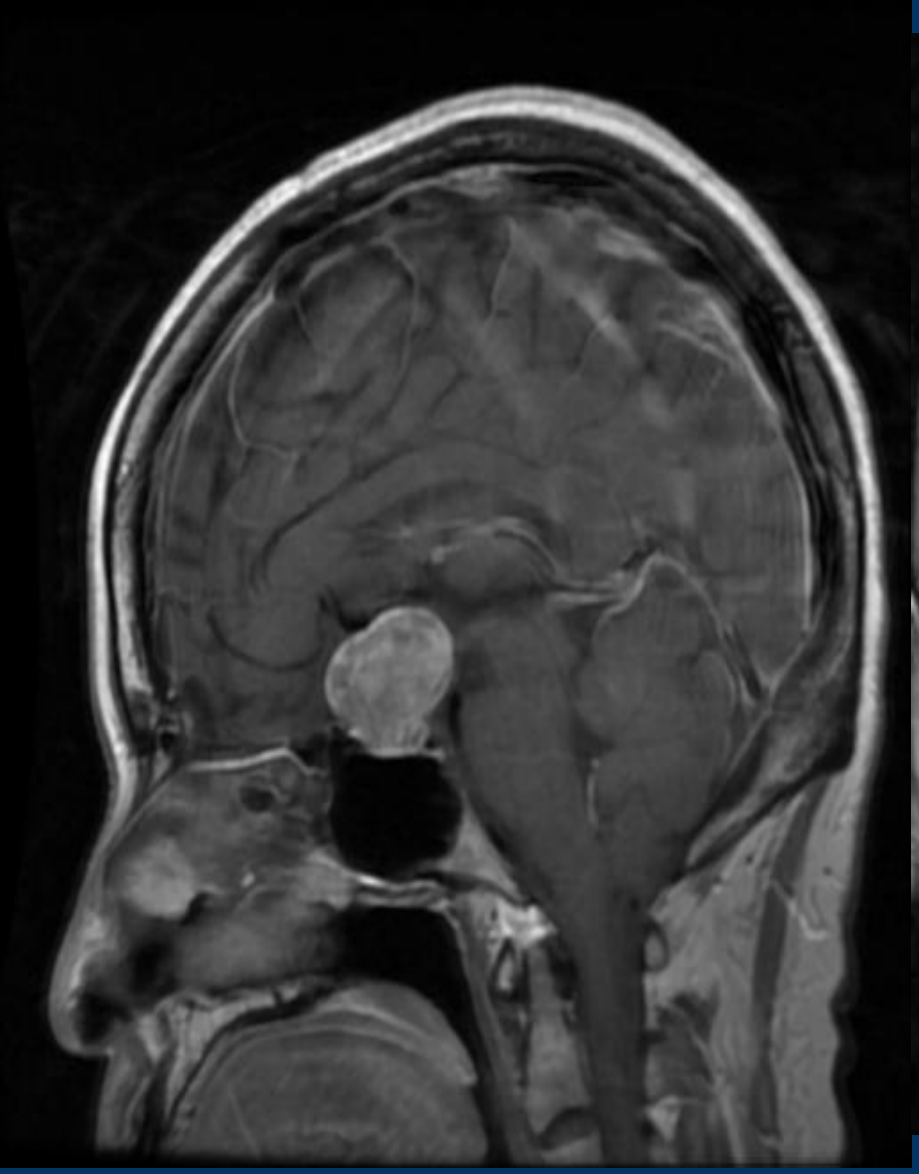
In the United States brain cancer rates are climbing at an alarming rate. As of 1/1/2025 the National Cancer Institute has 25,400 positive cases of these particular types of cancer.
The purpose of this project is to design, implement, and evaluate a deep learning-based solution for detecting brain tumors from MRI scans. Using a Convolutional Neural Network (CNN), the project aims to classify MRI images into distinct categories based on tumor type or absence of a tumor.

Goals/Problem to be solved

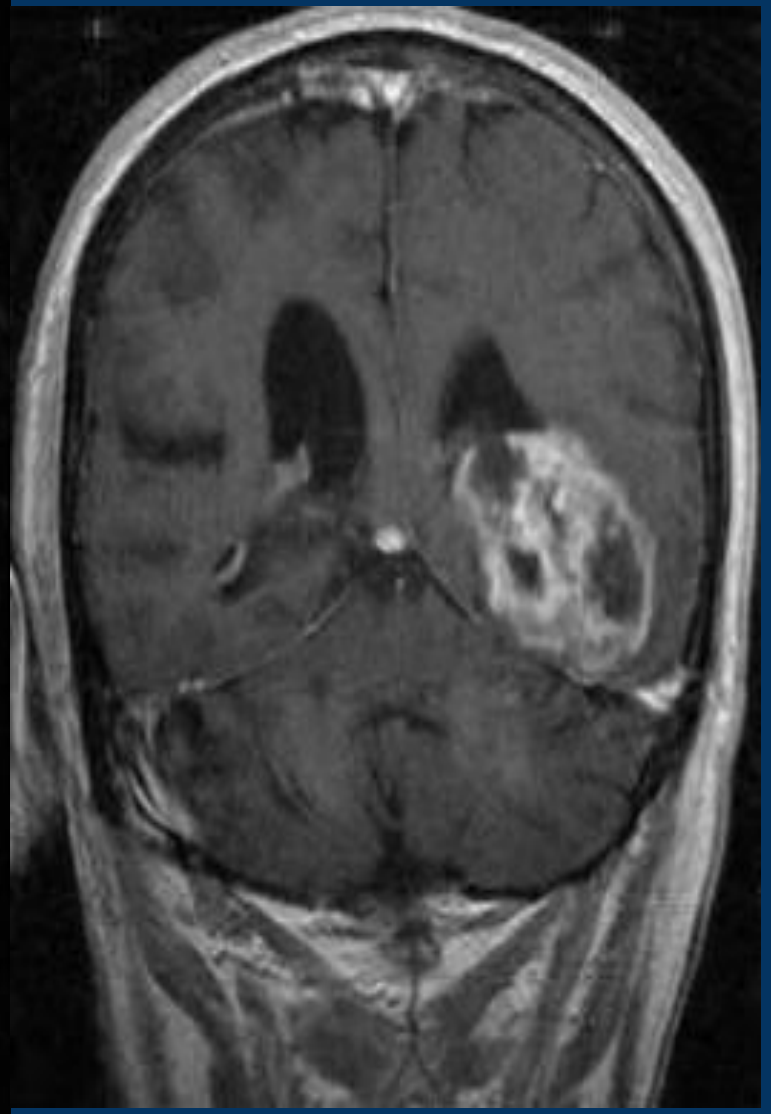
- Develop a machine learning model capable of identifying brain tumors in MRI scans.
- Improve accuracy of the model to the best of our abilities with room for improvement.
- Make the model’s results easy to interpret for future diagnoses.

Overview of Data Collection, Cleanup, and Exploration Process

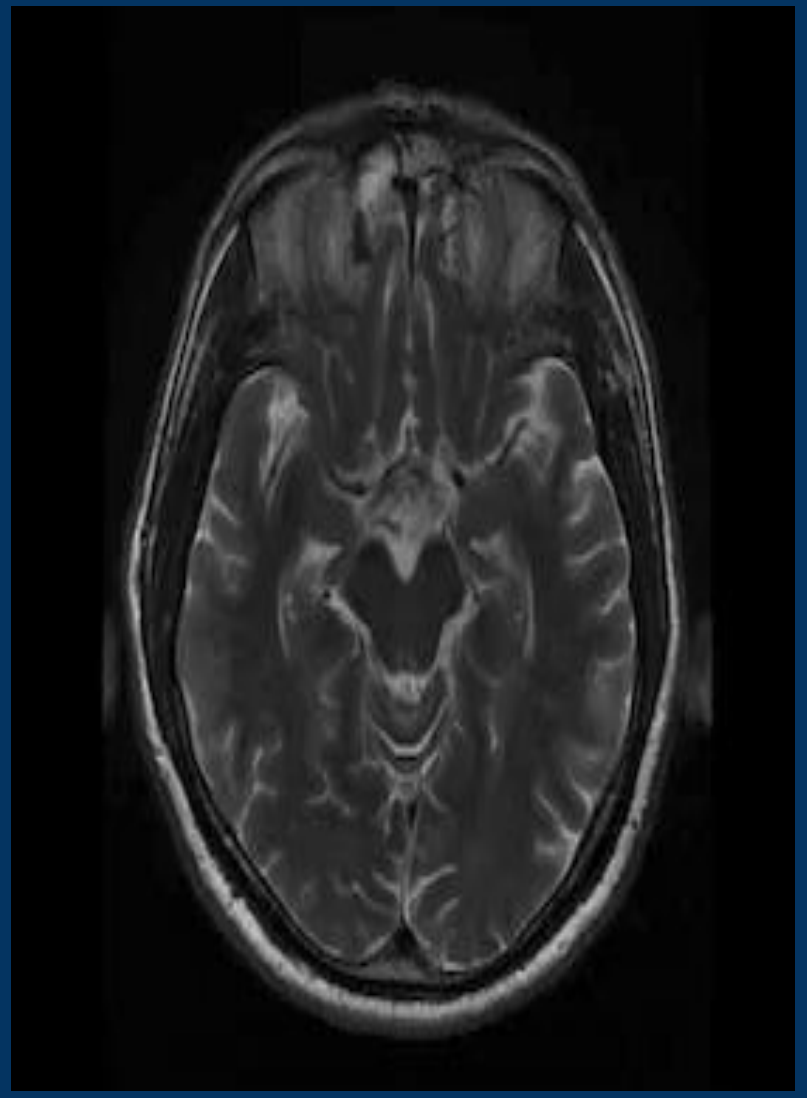
- Acquired large dataset from third party provider. (7,000 images of 4 types of MRI brain scans)
- Used keras image data generator to preprocess our image data (resize, normalize, convert to pixels).
- The image data was split into four categories:
  - No Tumor
  - Glioma
  - Meningioma
  - Pituitary
-



The first image is a Pituitary positive tumor



The second image is a Meningioma tumor



The last image is of a non tumor brain

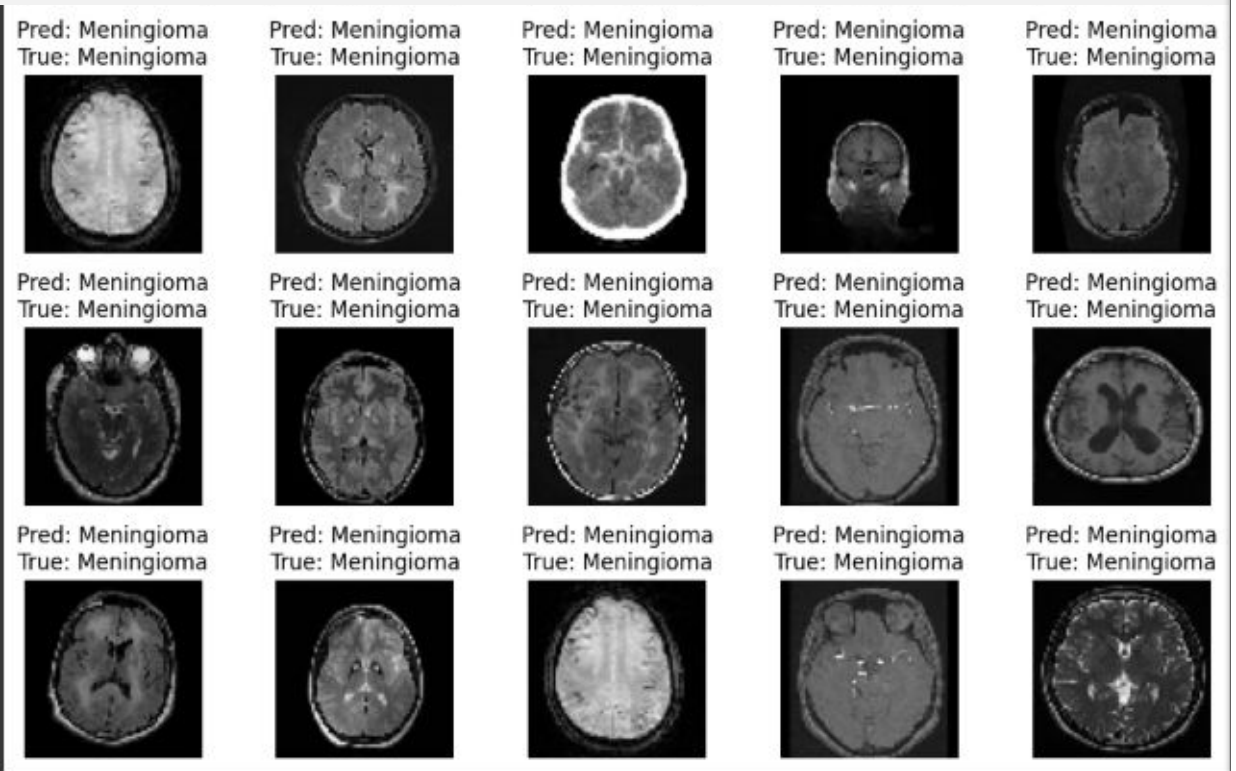
Approach taken to achieve goals

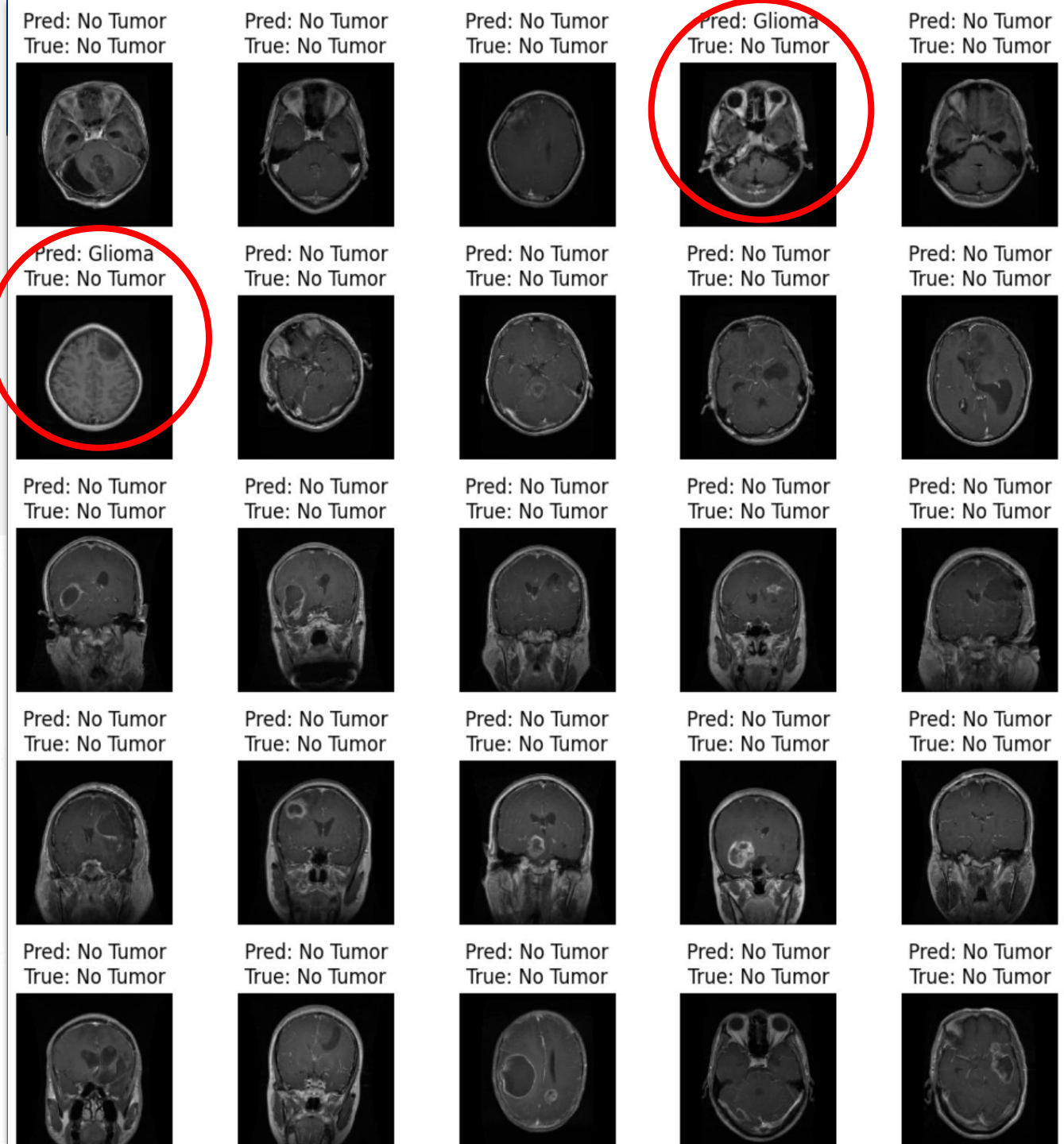
1. **Make daily goals** in order to achieve larger milestones
2. **Divide the work** to conquer the tasks
3. Team Support: **Helping one another** when facing difficulties

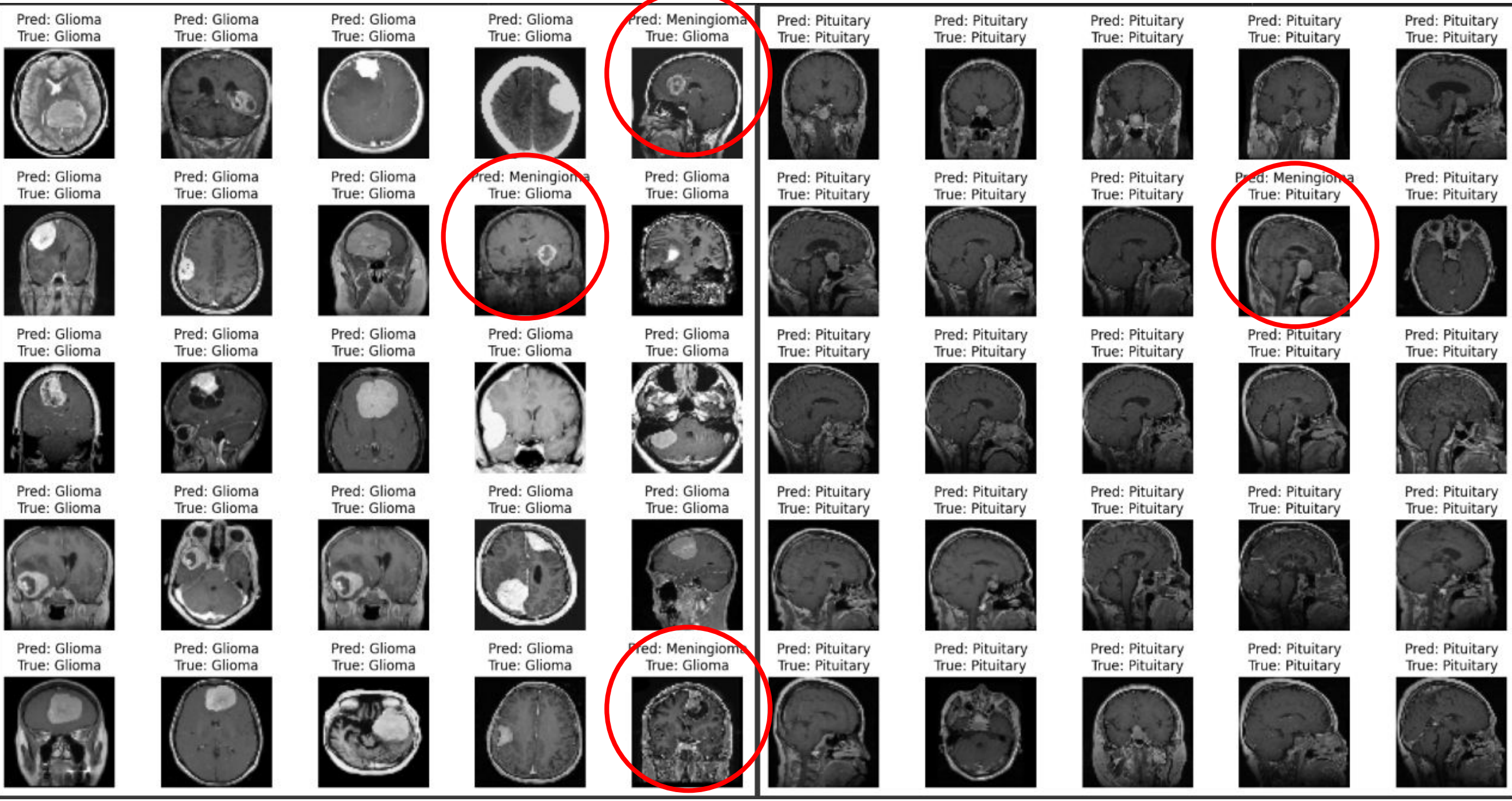
Result 1

Visual representation of a high accuracy Machine Learning CNN model

Can you spot all the false predictions?






Pred: Glioma
True: Glioma
Pred: Meningioma
True: Glioma
Pred: Pituitary
True: Pituitary
Pred: Meningioma
True: Pituitary

Result 2

BATCH CONFUSION MATRIX AND CLASSIFICATION REPORT

- Great visualizations of the accuracy of the CNN model
- A more in-depth understanding of the scores received (accuracy, loss, etc.)

1. Confusion Matrix

Predicted	Meningioma	All
True		
Meningioma	64	64
All	64	64

2. Classification Report

	precision	recall	f1-score	support
Meningioma	1.00	1.00	1.00	64
accuracy			1.00	64
macro avg	1.00	1.00	1.00	64
weighted avg	1.00	1.00	1.00	64

1. Confusion Matrix

Predicted	Glioma	Meningioma	No Tumor	Pituitary	All
True					
No Tumor	4	21	35	4	64
All	4	21	35	4	64

2. Classification Report

	precision	recall	f1-score	support
Glioma	0.00	0.00	0.00	0
Meningioma	0.00	0.00	0.00	0
No Tumor	1.00	0.55	0.71	64
Pituitary	0.00	0.00	0.00	0
accuracy			0.55	64
macro avg	0.25	0.14	0.18	64
weighted avg	1.00	0.55	0.71	64

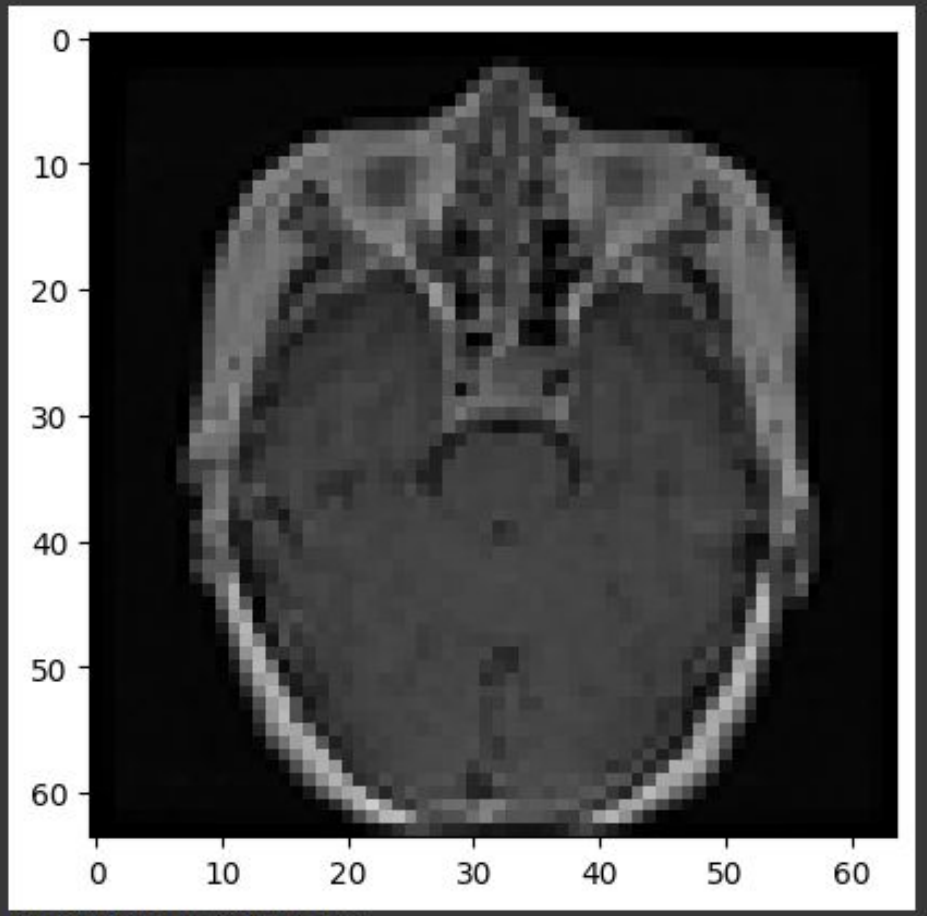
Result/Conclusion 3

SINGLE IMAGE TESTING

- Lower accuracy then batch testing
- Revealed the benefit of using the Image Preprocessor that we did

```
/content/drive/Shareddrives/Project 3/Project 3/test images for UI
Choose Files  Te-pi_0061.jpg
  • Te-pi_0061.jpg(image/jpeg) - 31591 bytes, last modified: 1/11/2025 - 100% done
Saving Te-pi_0061.jpg to Te-pi_0061 (3).jpg

User uploaded file "Te-pi_0061 (3).jpg" with length 31591 bytes
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 33ms/step
[[1.5688639e-09 1.9447116e-05 6.6622158e-07 9.9997985e-01]]
```




```
Prediction: Pituitary
True Class: Pituitary
```

Problems Encountered

Initial Data Acquisition

Many data distributors are rightly protected and require permissions to use their data. Some respond with permission after a couple of weeks.

Solution: Fortunately, after some searching we decided to lean on a familiar site, Kaggle, where we found a clean and well-organized dataset.

Google CoLab (Data Distribution)

We decided to use CoLab rather than code from our individual drives. However, the data could not easily be distributed through the typical Google Drive folders. Using an API also failed us.

Solution: In Google Drive, we created an all new “Shared Drive”. This allowed us to share the data with all-hands.

Problems Encountered Additionally

Model Results: Quality or Quick?

The models were taking rather long to process. To fix this we decreased the original batch size from 32 to 16, as well as lowering other parameters.
Solution: We instead increased the batch size and sought the quality and efficiency of the model instead of prioritizing speed.

Google CoLab (User-Interactivity)

Tkinter is a GUI toolkit and doesn't work on Google CoLab since CoLab runs on cloud servers and doesn't have graphical displays.
Solution: No UI for this particular project.

FUTURE CONSIDERATIONS

- **Enhance** the models accuracy by adding more layers, neurons, etc.
- **Try** out different trained models for varying results.
- **Integrate** the current trained model that we created into a portable application that can be used for real-time diagnosis in emergency or non emergency situations .
- **Introduce** new image data and retrain the model to also predict/diagnose the presence of other neurological diseases or abnormalities.

In conclusion as a group we were successful in crafting a model that has a 90%+ accuracy rate and a 10% loss of reading MRI's.
In addition to this we turned the trained model into a UI that allows medical personnel to upload and analyze a single MRI scan in real time.