BRAINIAC

SMARTER VISION, SHARPER DECISIONS

TEAM: MCDONALD BRIDGE

Problem Statement

OBJECTIVE

Develop a program that detects brain tumors in MRI scans.

TASK

Classify MRI images as "Tumor" (Yes) or "No Tumor" (No).

DATASET

Pre-augmented MRI images categorized into Yes/No folders.

PROBLEM WITH CURRENT TOOLS

01

LONG WAIT

A diagnosis for an MRI and CT scan can take up to 90 days [1]

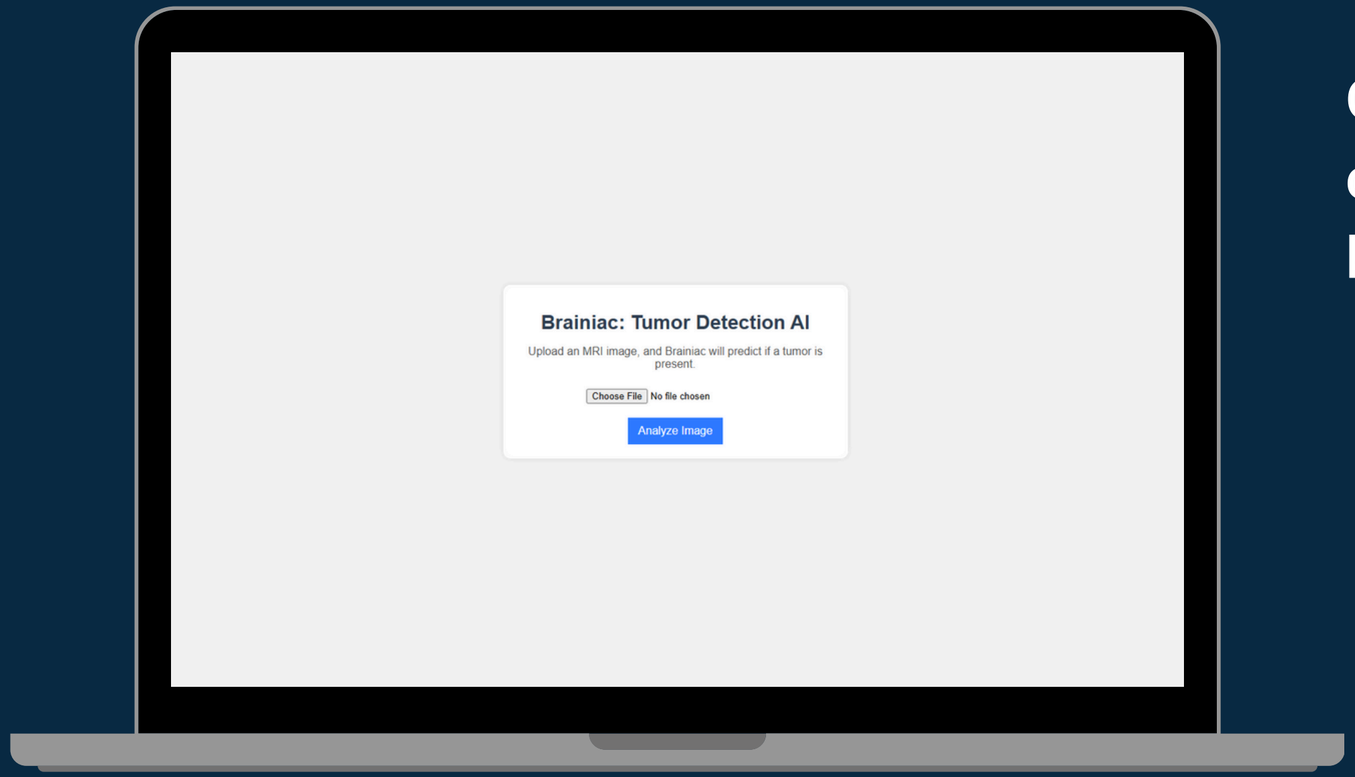
02

OVERBURDENED HEALTHCARE SYSTEM

03

ETHICAL CONCERNS WITH AI IN HEALTHCARE

Our Solution: BRAINIAC



Quick tool to get a diagnosis of a MRI scan image of a brain

- Easy to use
- Accurate
- Efficient
- Smaller model

Model Choice: Vision Transformers (ViT)

Vision Transformers (ViT) are **deep learning models** that use self-attention mechanisms (like NLP models) to process images.

Unlike CNNs, **ViTs divide images into patches** and learn long-range dependencies effectively.

Why?

- Pretrained models are effective
- Handles Complex Patterns Better than CNNs
- Less Data Required for Fine-Tuning

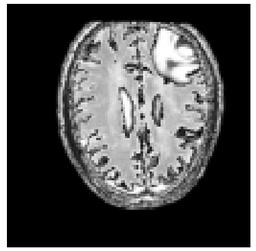
Results from other models: EfficientNet (~46), 2 dimensional CNN (~44%)

Training Flow

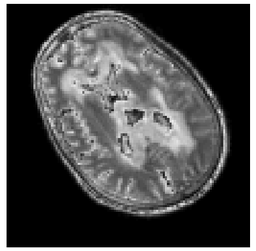
1. Split Data: 70% training, 15% validation, 15% test.
2. Load Pretrained Model: Used google/vit-base-patch16-224
3. Data Augmentation: Applied blurring and Gaussian noise to training data.
4. Fine-Tune Model: Trained on augmented data.
5. Model Evaluation: Compared performance with CNN and EfficientNet to select the best model.

Original

Original

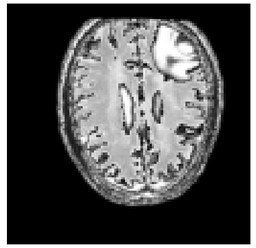


Original

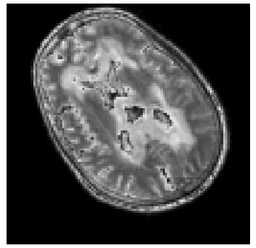


Gaussian Noise

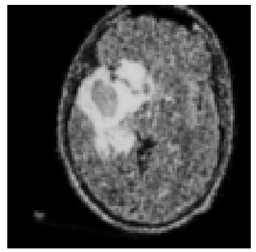
Gaussian Noise



Gaussian Noise

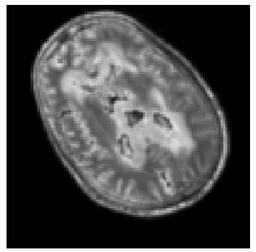


Blur

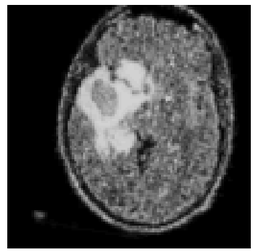


Blur

Blur

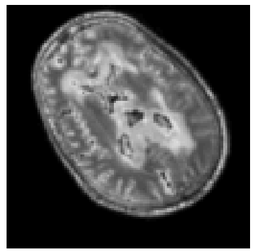


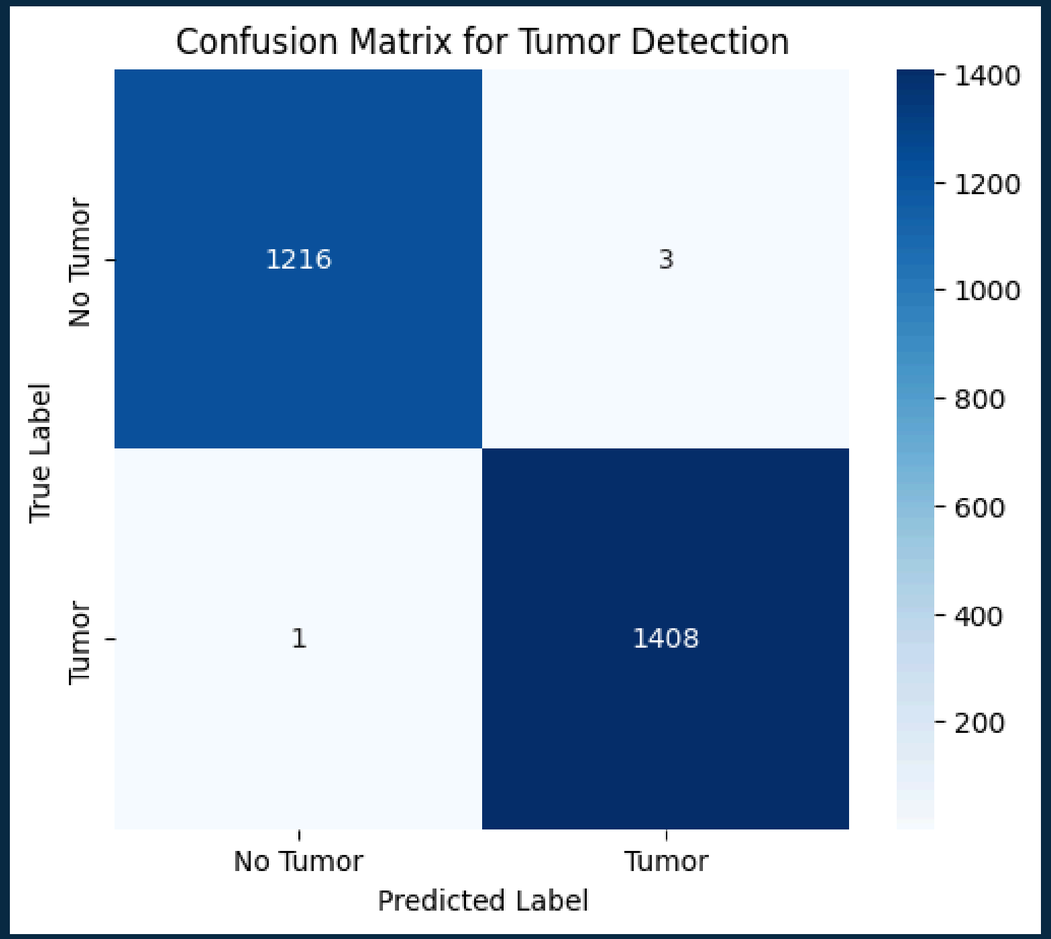
Downsample-Upsample



Downsample-Upsample

Downsample-Upsample

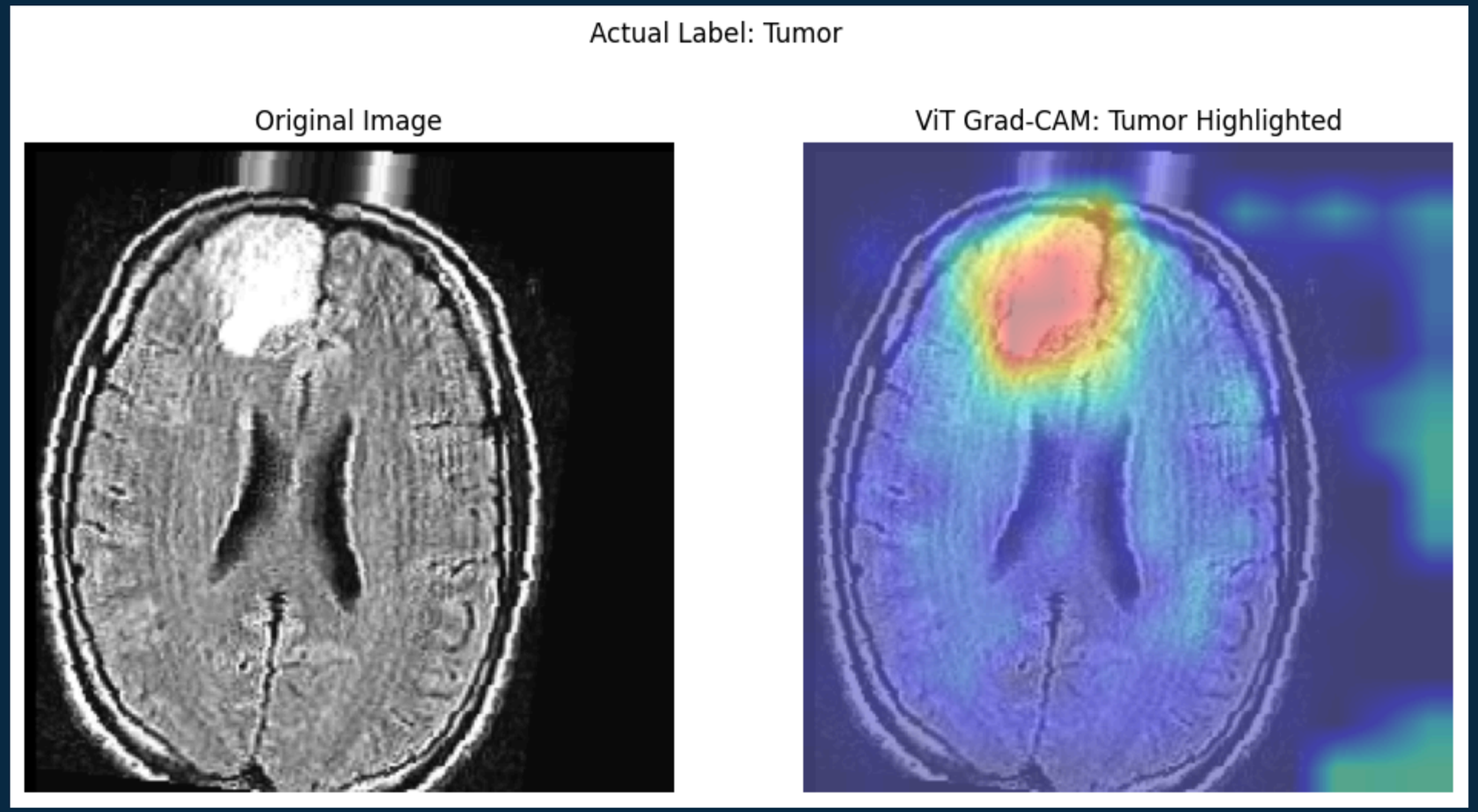




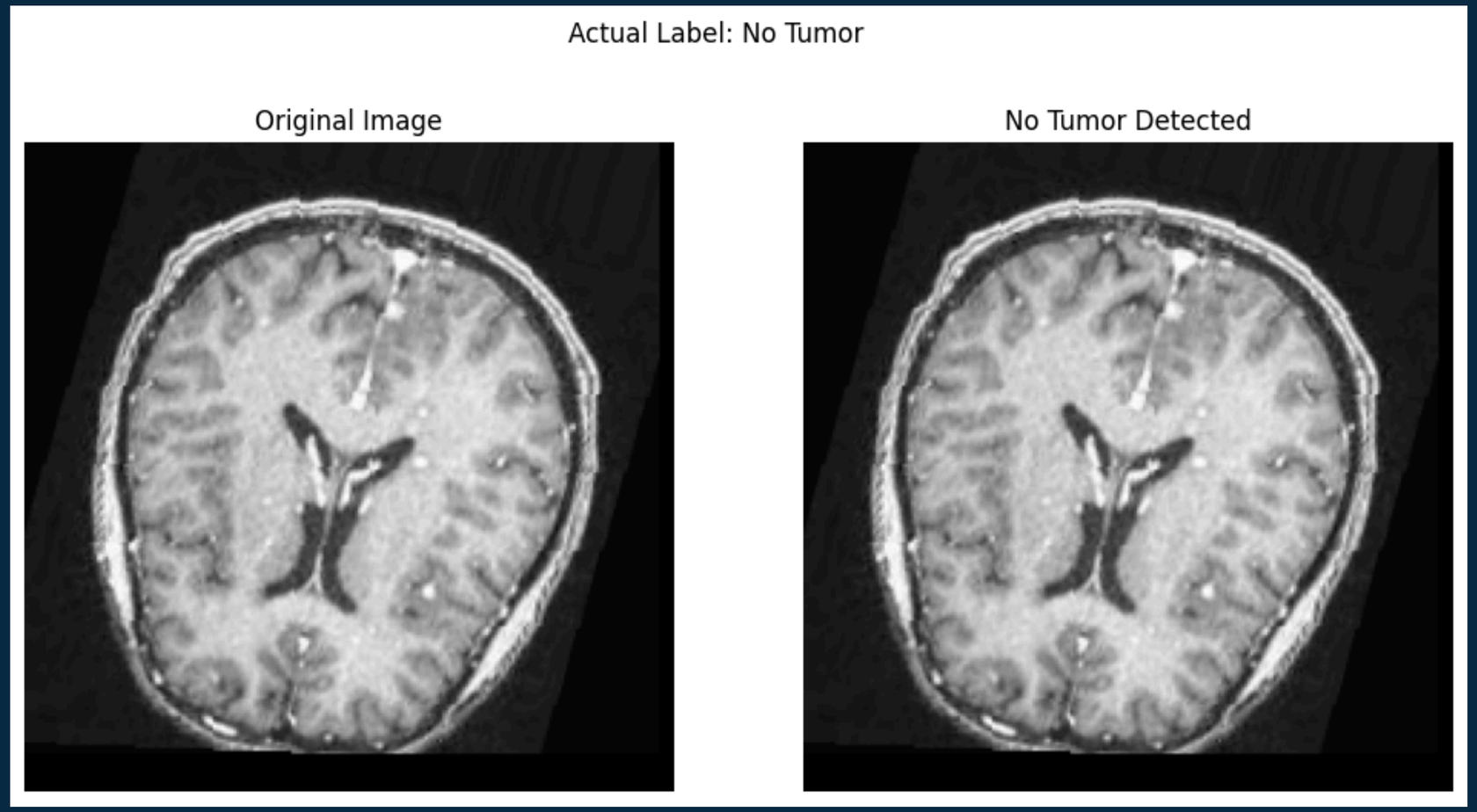
Confusion Matrix

- Few misclassifications (very high accuracy).
- 1 false negative, 3 false positives.
- Model performs well in both classes.

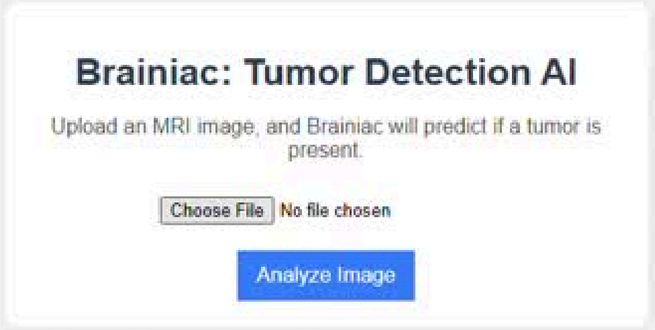
Visualizing Model Attention



Visualizing Model Attention



Test with Tumor



Test with No Tumor

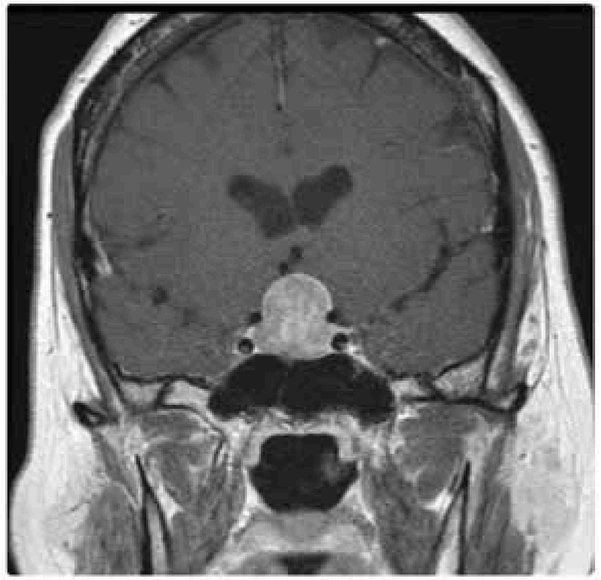
Brainiac: Tumor Detection AI

Upload an MRI image, and Brainiac will predict if a tumor is present.

Choose File No file chosen

Analyze Image

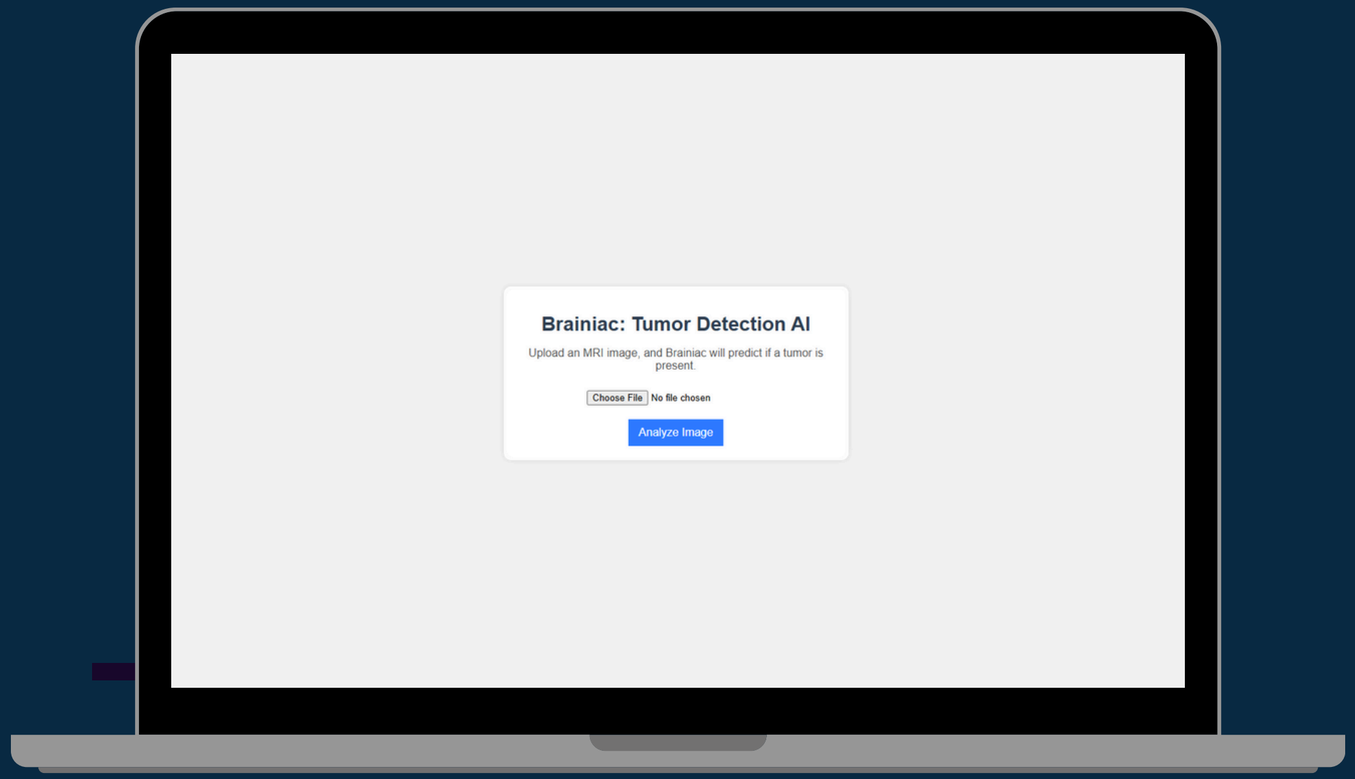
Uploaded Image:



Prediction: tumor
Confidence: 0.9999854564666748

BRAINIAC

Why our solution?



01 High Accuracy and Performance

02 Faster & Cost-Effective

03 *“The Ethical Engineer”*: Transparent and Adaptable

ETHICAL CONSIDERATION

1. **EXPLAINABILITY & TRANSPARENCY -** Using Grad-Cam to highlights where in the image
2. **FAIRNESS** - Trained with lower quality images to replicate machines that can be older or movement when gathering images
3. **AWARENESS -** Model assists radiologists but does not replace expert medical judgment, reducing the risk of AI misdiagnosis.
4. **SUSTAINABILITY** - Used pre-trained model to reduce carbon footprint from training large AI models from scratch.
5. **Minimizing False Negatives** - Prioritized reducing false negatives (missed tumors) to ensure patient safety.

👩‍💻How its built?

Frontend:

- Flask app built with Python
- HTML/CSS

Model:

- Python
- Used Colab for training and testing

Libraries

- Grad-Cam
- PyTorch
- Huggingface-hub , etc

Challenges we faced.... and how we overcame them 💪

New to ML terminology and tools	→	Research Classification models and test them
Training took a long time	→	Make changes in the training process
Lots of things we wanted to implement	→	Prioritize what we can get working in < 8 hours

BRAINIAC

Next Steps / Future

01 Consider demographic details of data

02 Expand UI capabilities when used by the public

BRAINIAC

TEAM: MCDONALD BRIDGE

THANK YOU

References

[1] https://www.fraserinstitute.org/studies/waiting-your-turn-wait-times-for-health-care-in-canada-2023