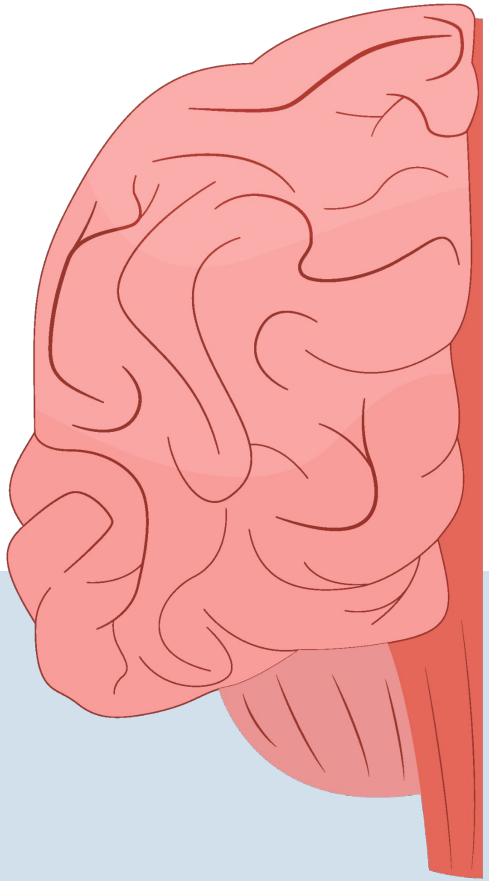

CEC 2025 Programming Presentation

Peggy's Cove

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Arun Alex

Roadmap

01

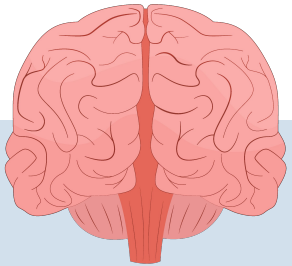
Problem

02

Solution

03

Demo



04

Ethics

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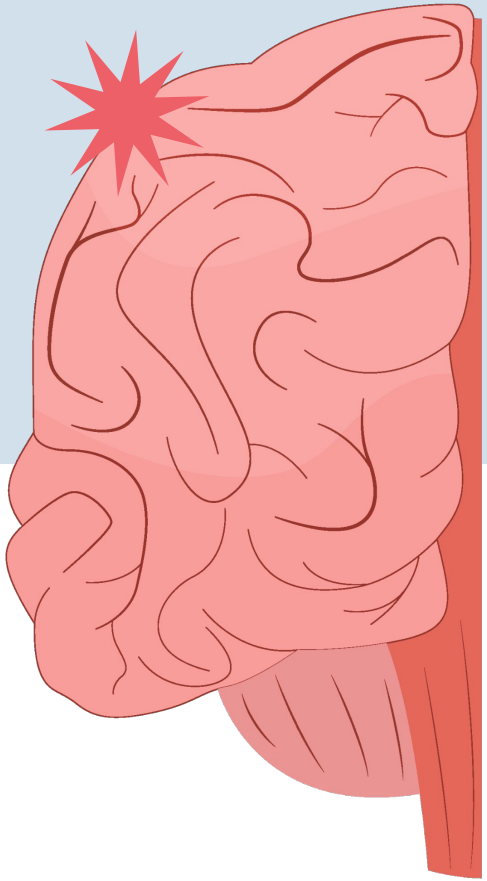
Results



01

Problem

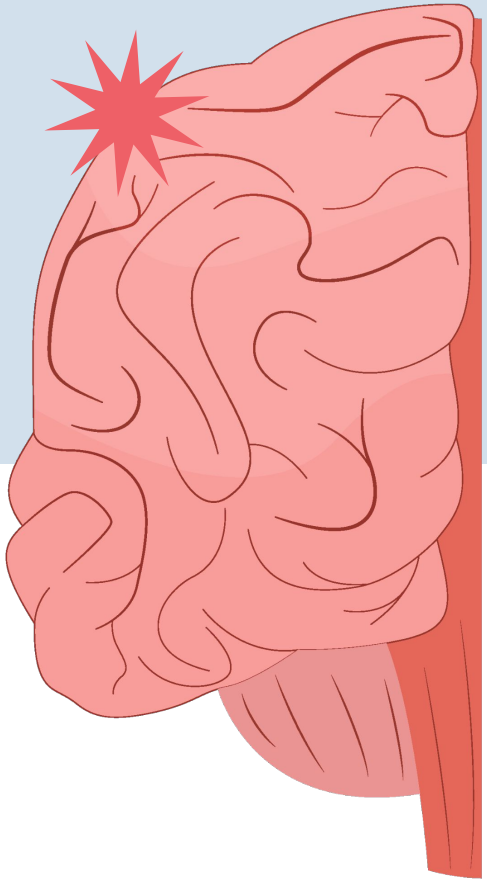
Introduction

Problem statement

JBOW Hospital is overloaded with work and needs help diagnosing and treating patients with brain tumors.

Context

- An AI-based solution will assist in patient care and tumor identification.
- AI usage in medical industries requires extensive care and consideration
- The solution should not sacrifice patient health in any way, shape, or form.



02

Solution

Engineering Decisions

Recall was prioritized over precision, since the consequences of a false negative are far greater than a false positive

The model is only trained using images of brain scans. This means that other types of images can produce unexpected (but also irrelevant) results.

ML Training

Efficiency

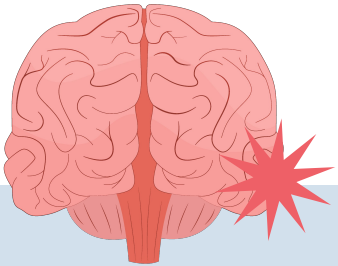
Train as efficiently as possible without any sacrifice in accuracy of model

Data Noise

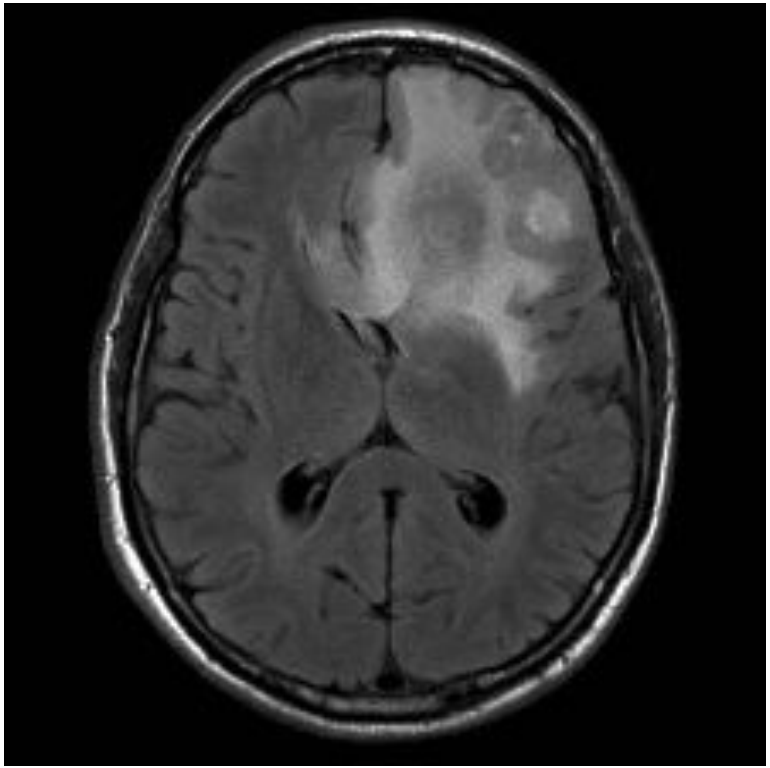
Random noise (image transformations, rotations, color, etc) introduced into training set to create a robust model

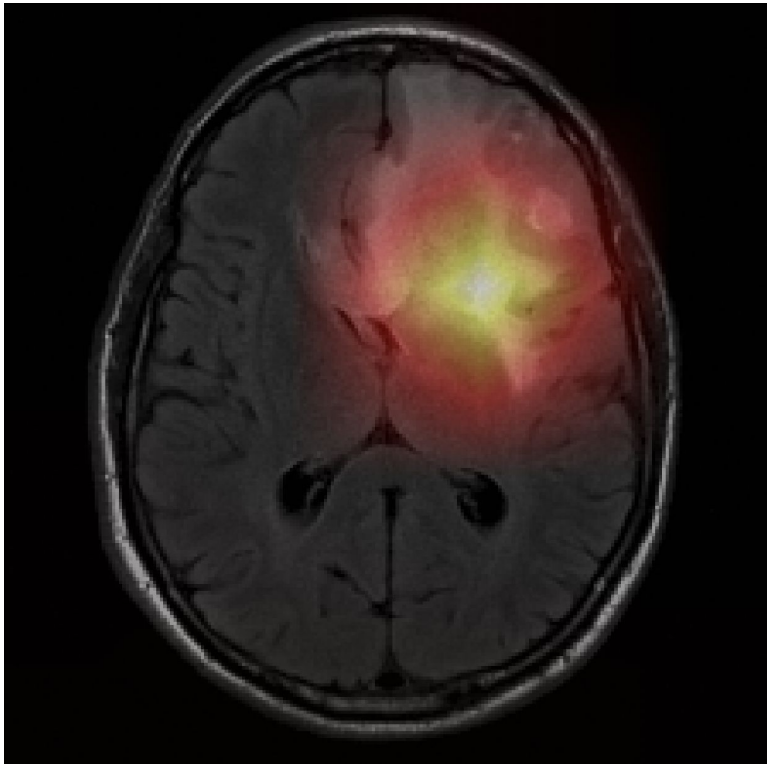
Training Model

EfficientNet model used due to its excellence at high performance with low parameters (each image is either tumor or no tumor, no other data provided)



Innovation

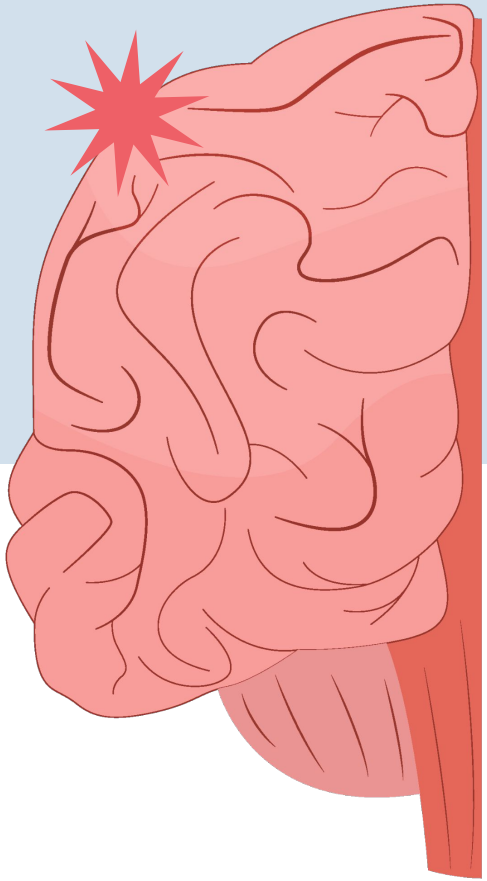




Data Utilization

All images provided in the folders CEC_2025/yes and CEC_2025/no directories were used for training and testing of our model. No additional data was used for training.

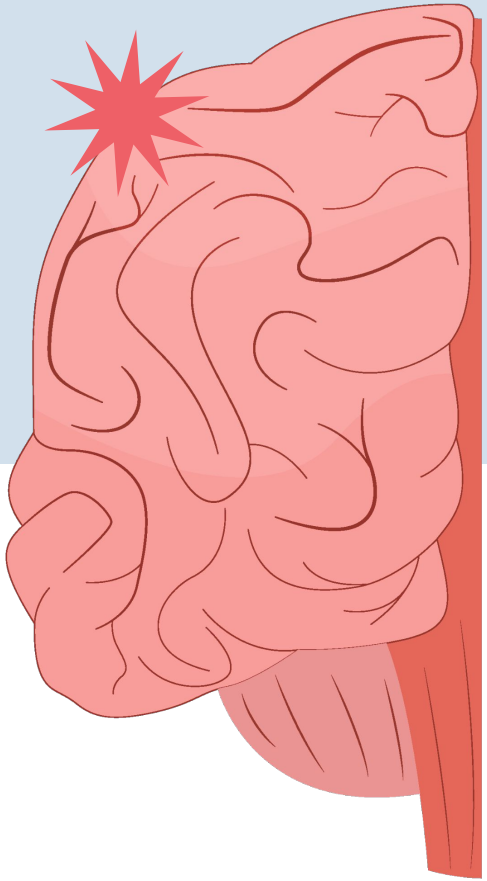
20% of images are used as validation set when creating the model, the rest is the training set.



03

Demo

Live deployment



04

Ethics

Ethics

Liability

Where does the blame lie with incorrect diagnoses, the doctor or the developer?

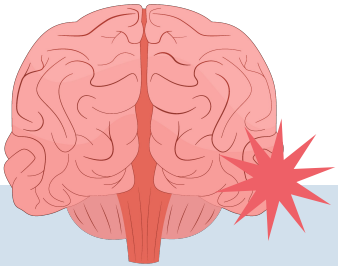
Reliability

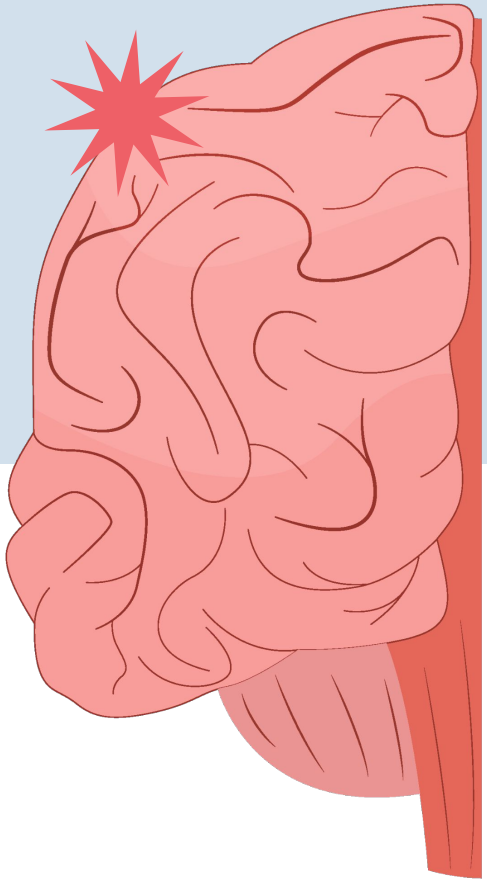
How accurate must an AI model be to be relied on independently? And how many resources should be used to mitigate risk from AI diagnoses?

Bias

Bias can be introduced through race, sex, economic status, etc [1]

Brains with deformities or that are otherwise abnormal can also create bias





05

Improvements

Batch Imaging

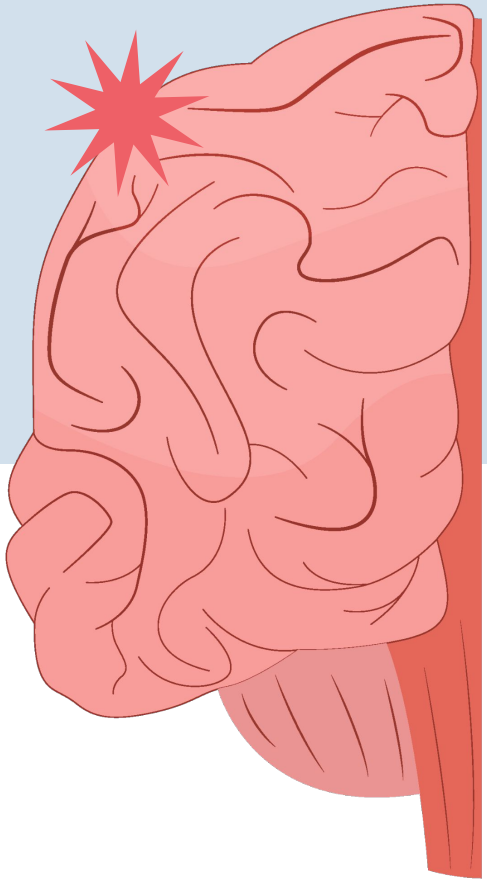
In a real world use case, MRI scans take many images of the same brain at the same time.

These images should be tested together to increase reliability in detecting a tumor.

Training Data

The dataset we trained on lacks images of brains with abnormalities that aren’t tumours, leading to an increased amount of false negatives

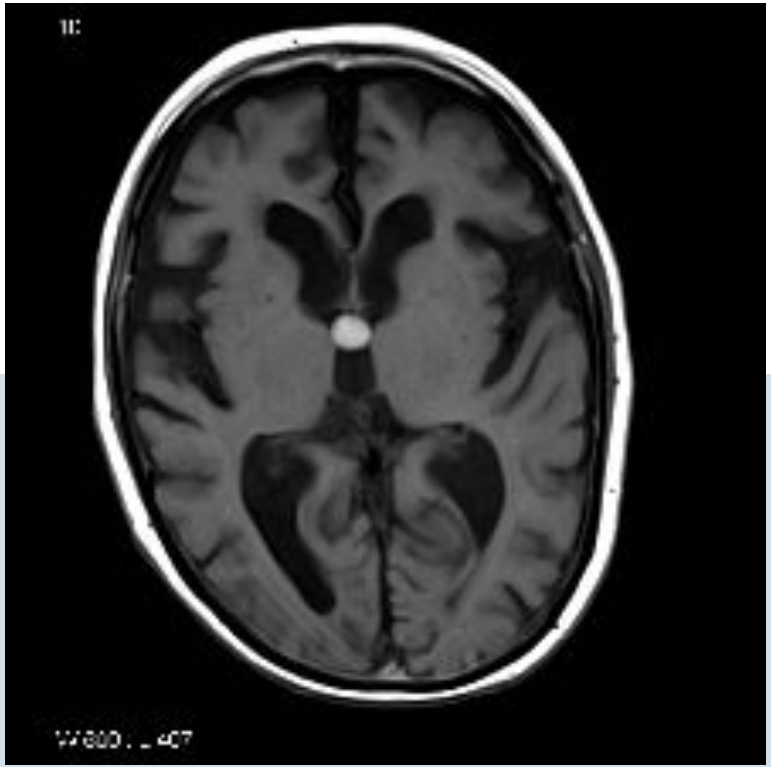
More training data with smaller tumours would increase detection of tumours in scans only showing a small slice of a tumour



06

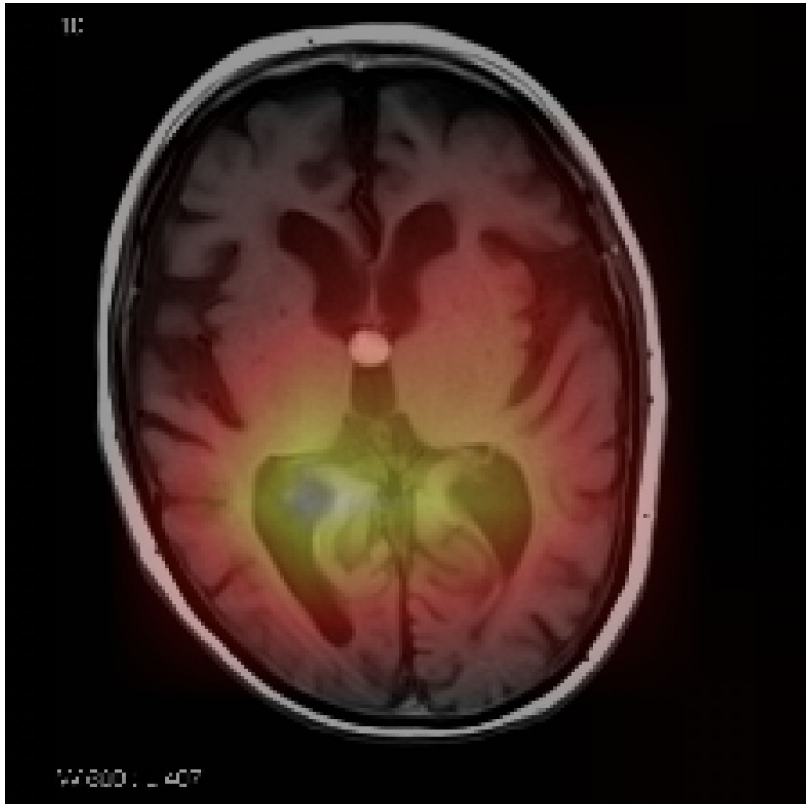
Results

The best training iteration out of ~17,000 images resulted in only...



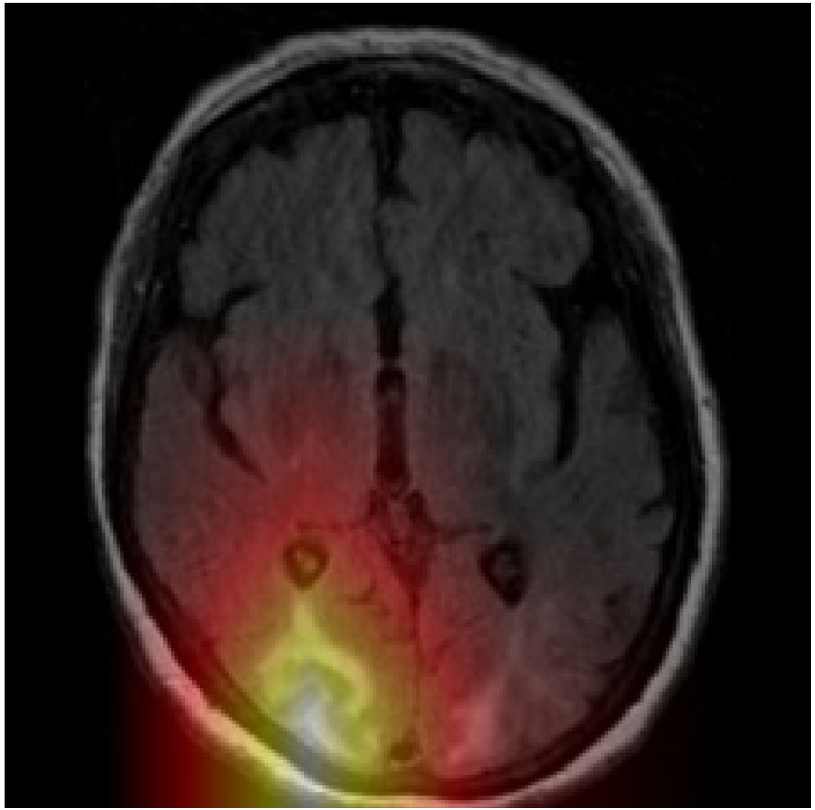
3x False Positives

2x False Negatives



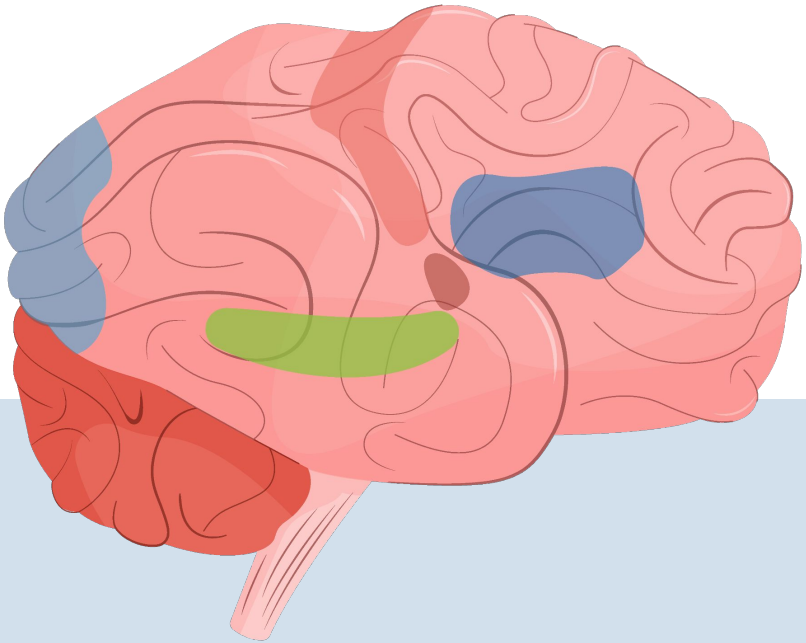
False Negative

- Image is only one 3-7 mm slice of the brain
- Scan likely has many images for the individual's brain
- Other images would likely capture the tumor, resulting in a true positive



False Positive

- An abnormality that wasn't a tumour was falsely flagged as a tumour.
- Not as critical as a false negative because it doesn't threaten someone's life.



99.89% Accuracy

How likely the model is to accurately predict a result

99.93% Recall

How likely the model is to predict actual positives

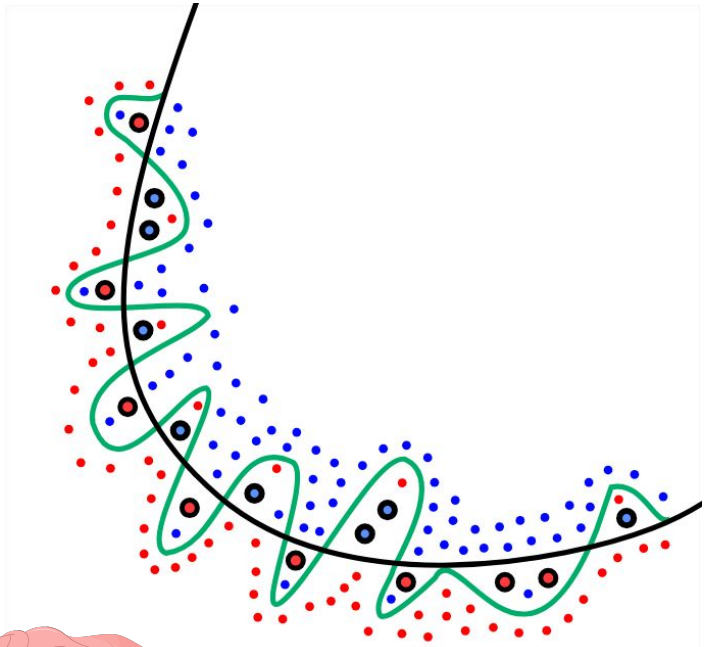
99.86% Precision

The proportion of positive identifications that are actually correct

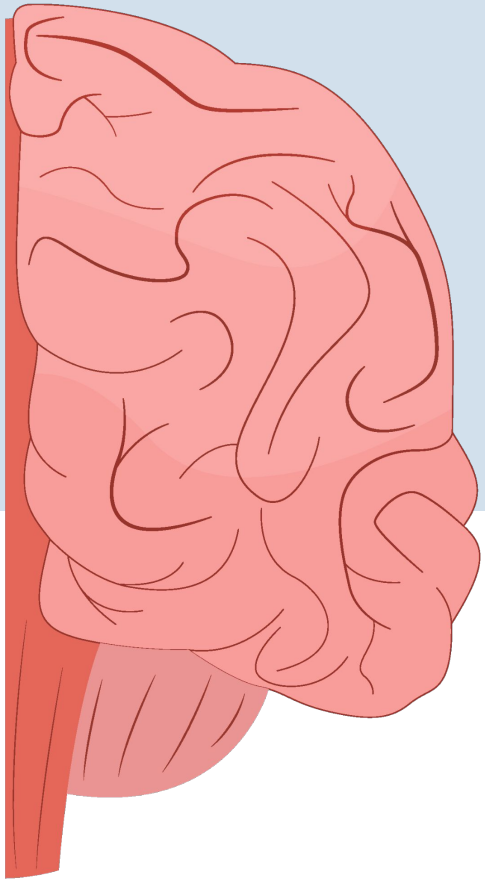
Overfitting?

No!

- Accuracy, recall, and precision taken from untrained data
- As mentioned earlier, training set images modified to replicate real-world noise
- Tested against real-world MRIs outside of training/testing/validation set



Thank you for listening



References

- [1] J. Herington *et al.*, “Ethical considerations for Artificial Intelligence in medical imaging: Data collection, development, and evaluation,” *Journal of Nuclear Medicine*, vol. 64, no. 12, pp. 1848–1854, Dec. 2023. doi:10.2967/jnumed.123.266080