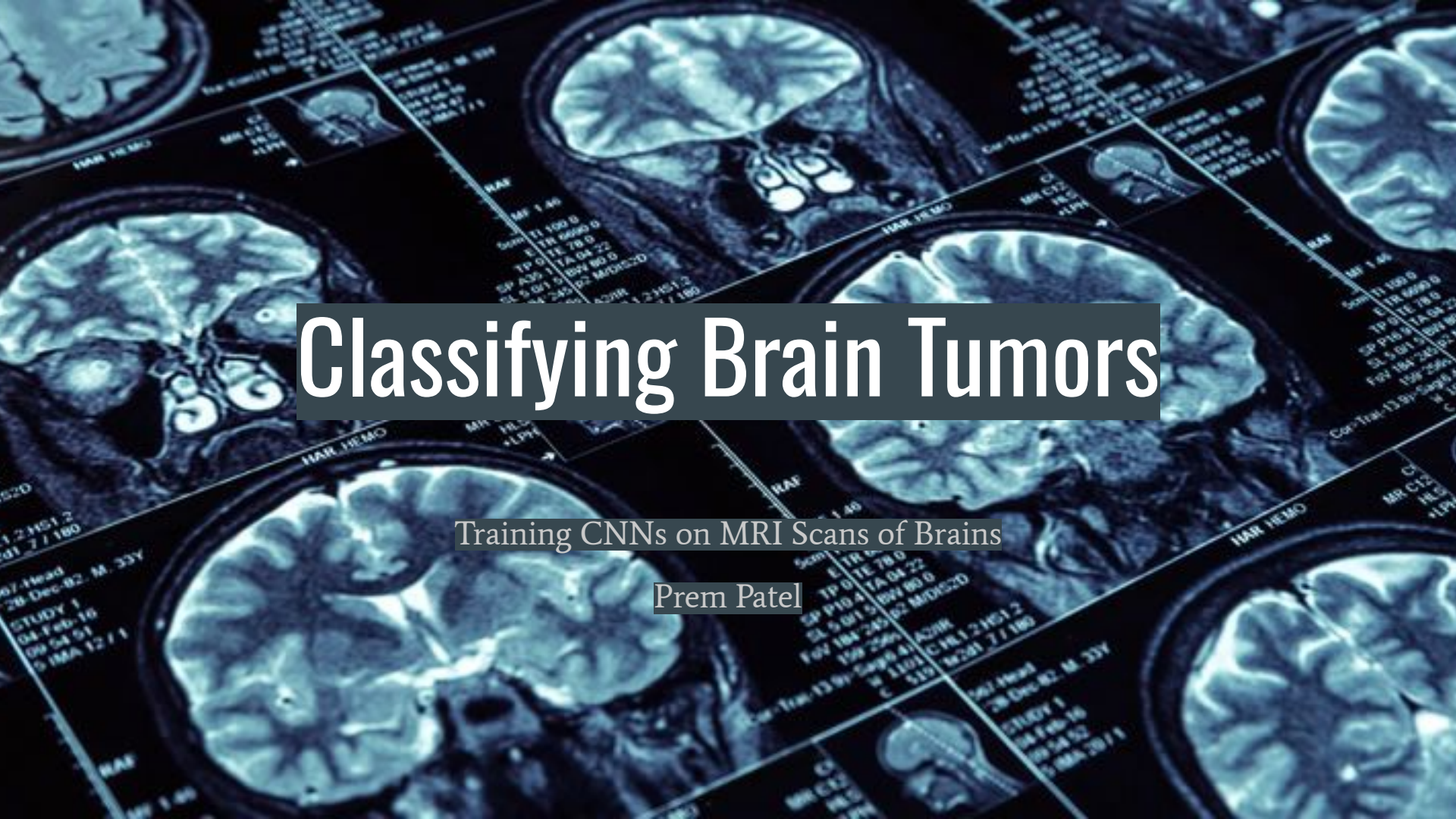
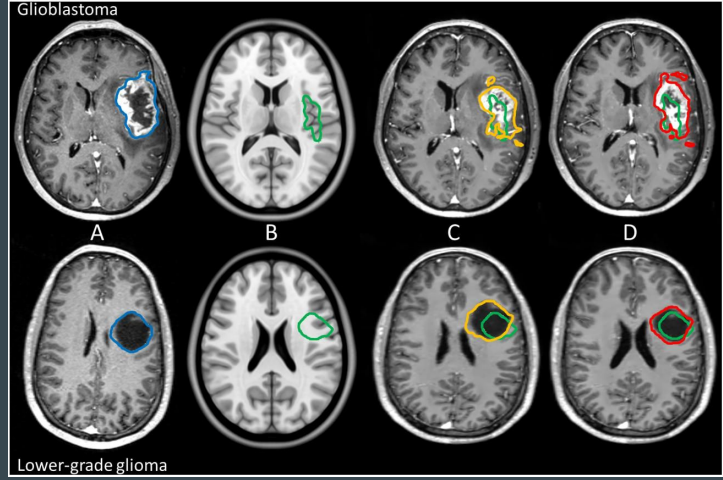


Classifying Brain Tumors

Training CNNs on MRI Scans of Brains

Prem Patel

The Problem



- Disease classification is hard
- Brain tumors vary in size, shape, severity, location
- Like any form of disease, early detection is ***imperative***
- Physicians and medical professionals are burdened now more than ever
- Worse for the patient, results can take several days to be returned

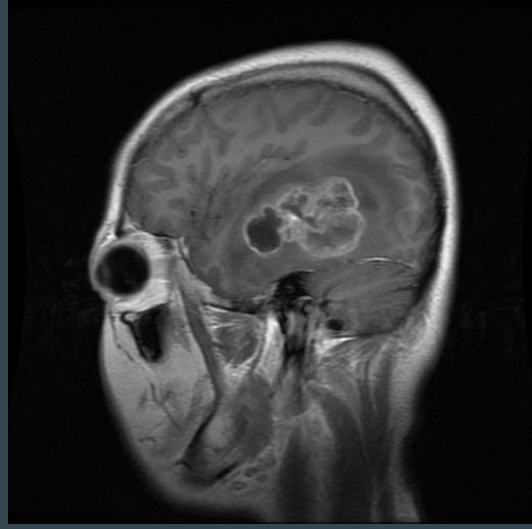
The Goal

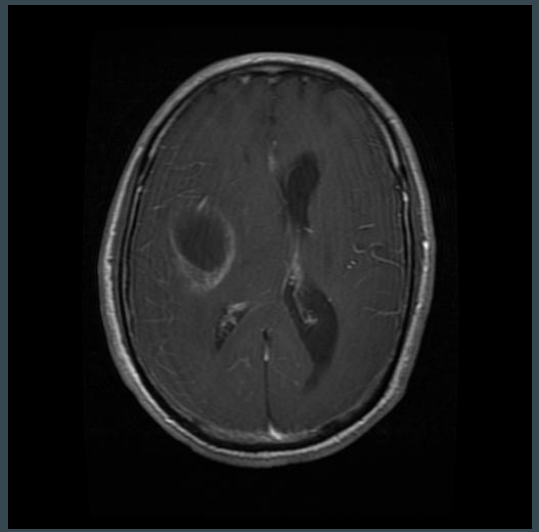
- Biomedical Data Scientist @ UW Health (University of Wisconsin)
- I want to show the board that CNNs can be trained to detect all manner of diseases
  - I will focus on 7000+ images of MRI scans of brains (healthy & non-healthy)
- Reduce the time from scan to diagnosis
- Be complementary aids for our doctors and nurses

Brief Background on the Classes

Gliomas

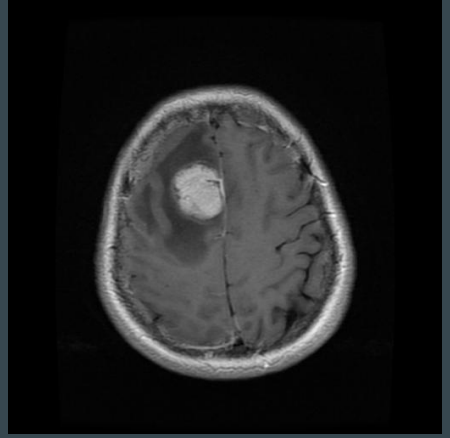
- Type of brain cancer that forms in the glial cells of the brain and spinal cord
- Typically cancerous and can spread (malignant) → Glioblastomas
- 5-year survival rate from 5% to 95%
- Account for roughly 33% of all brain tumors

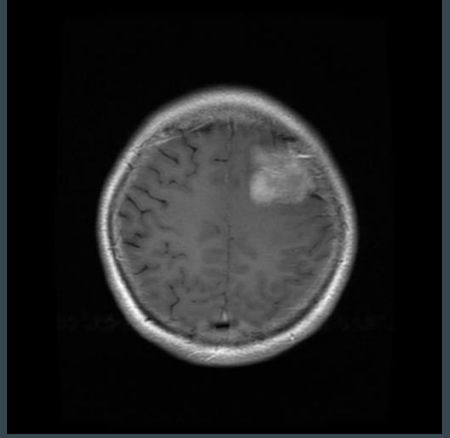


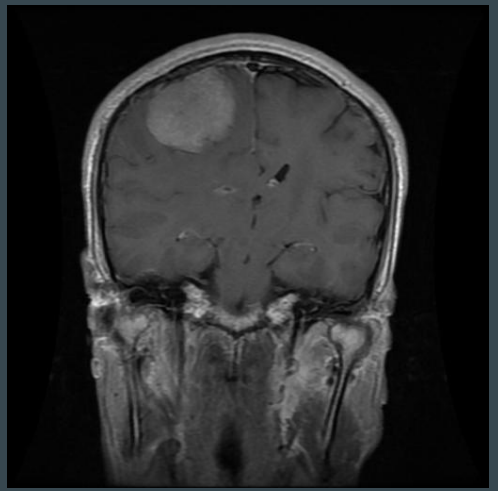


Meningiomas

- Forms in the meninges, tissue covering the brain & spinal cord
- *Majority* are benign, but can regrow if not completely removed
- Depending on age, 5-year survival rates vary from 60% to 95%

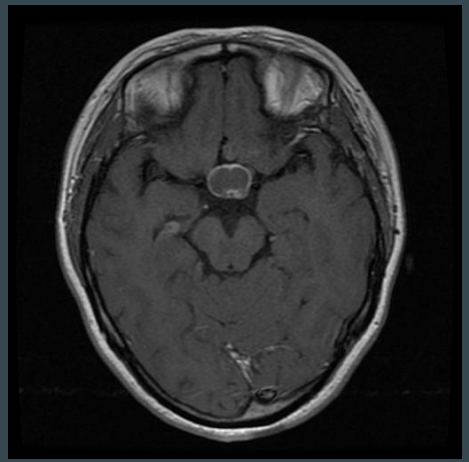






Pituitary

- Originate in the Pituitary gland
- Most are benign, and non-cancerous (pituitary adenomas)
- Outlook of recovery is considered very good ***if*** detected early



The Strongest Model - ***Xception***

The Model

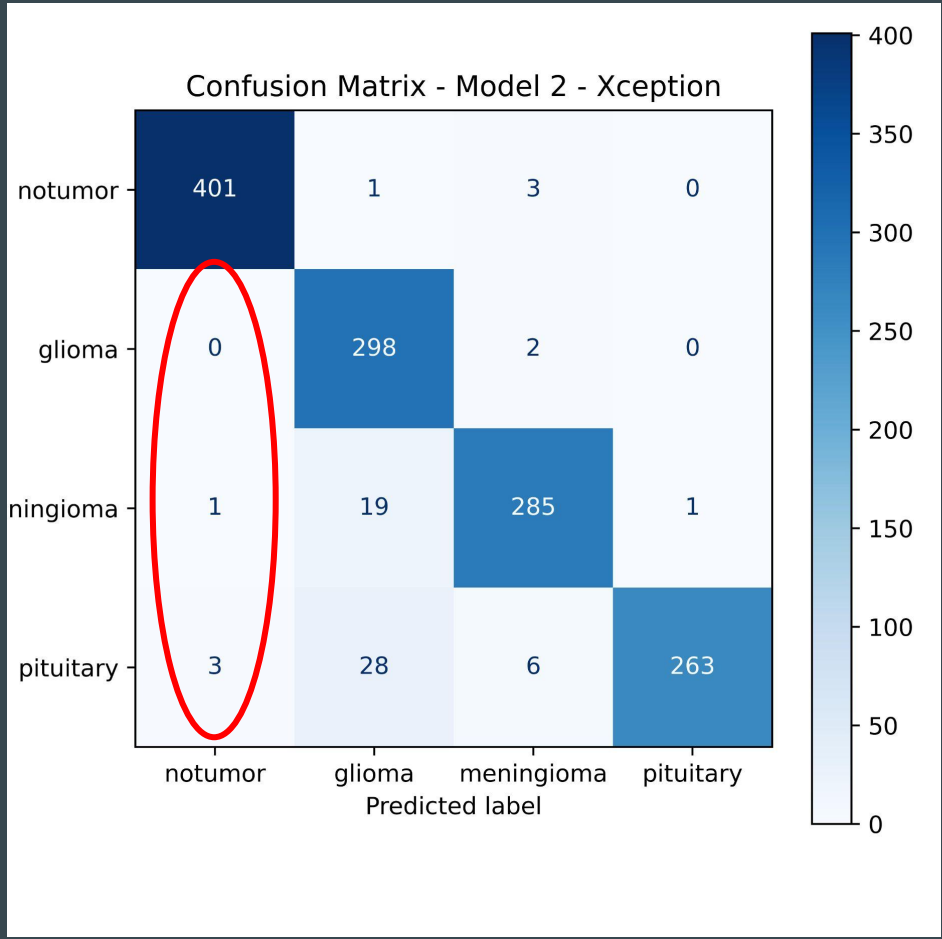
- Using transfer learning from a pretrained model, Xception
- Model has been trained on over 1 million images
- Appended Dropout layers to limit overfitting

```
Model Summary:
====================
Model: "sequential_6"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 xception (Functional)       (None, 2048)              20861480

 flatten_6 (Flatten)         (None, 2048)              0

 dropout_6 (Dropout)         (None, 2048)              0

 dense_9 (Dense)             (None, 64)                131136

 dropout_7 (Dropout)         (None, 64)                0

 dense_10 (Dense)            (None, 4)                 260

=================================================================
Total params: 20992876 (80.08 MB)
Trainable params: 20938348 (79.87 MB)
Non-trainable params: 54528 (213.00 KB)
_________________________________________________________________
```

Performance

- Arguably, strongest indicator of the model is the ability to identify a tumor (binary classification)

	notumor	glioma	meningioma	pituitary	accuracy
precision	0.990123	0.861272	0.962838	0.996212	0.951182
recall	0.990123	0.993333	0.931373	0.876667	0.951182



Generating Predictions - Demo

Thank You

Questions?