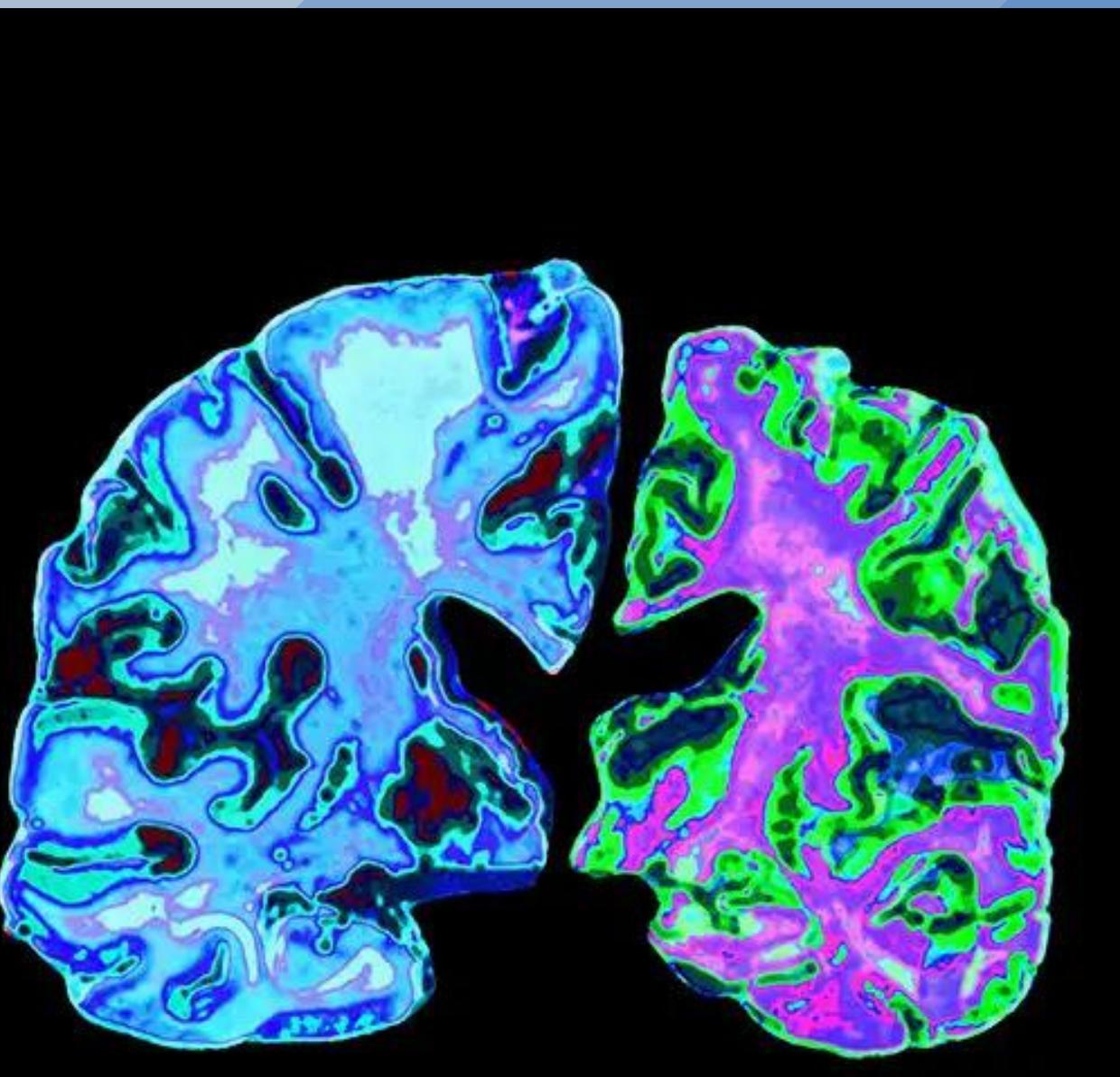


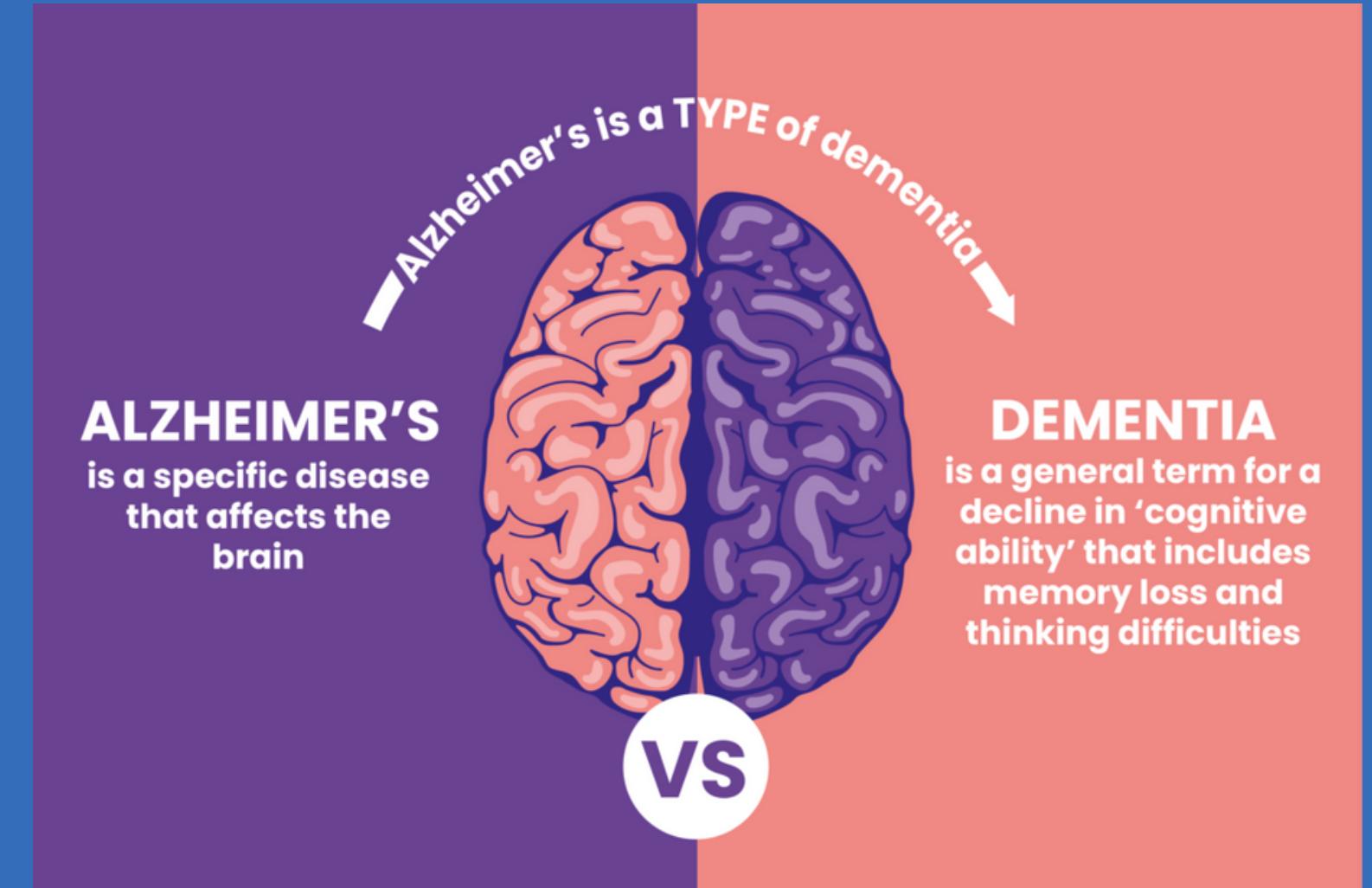
ALZHEIMER'S IMAGE CLASSIFICATION



By: Mohamed Katherhassan

What is Alzheimer's?

- Alzheimer's disease is the most common type of dementia.
- It is a progressive disease beginning with memory loss and leading to loss of the ability to carry on a conversation.
- Alzheimer's disease involves parts of the brain that control thought, memory, and language.
- It can seriously affect a person's ability to carry out daily activities.



Business Understanding



Problem Statement:

- Develop a deep learning model to accurately classify brain MRI images of Alzheimer's disease.

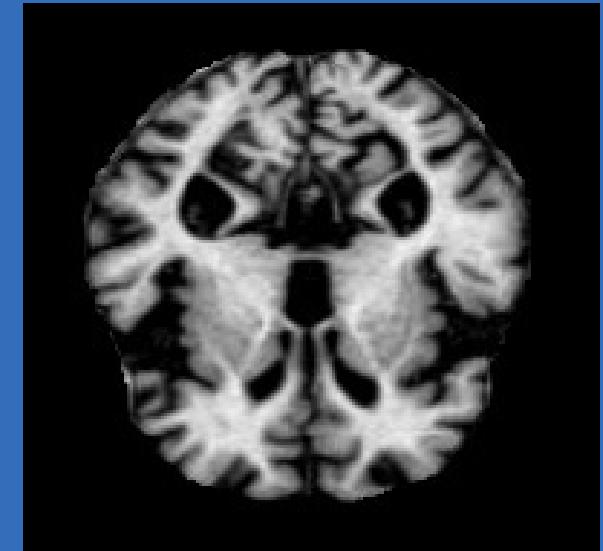
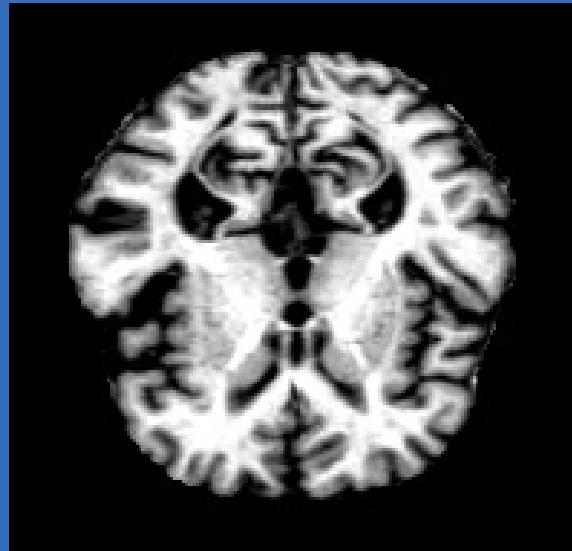
Target Audience:

- Healthcare professionals
- Neurologists
- Medical Researchers
- Data scientists

Impact:

- *Early Detection*
- *Reduced Healthcare Costs*
- *Research Advancement*

The Data

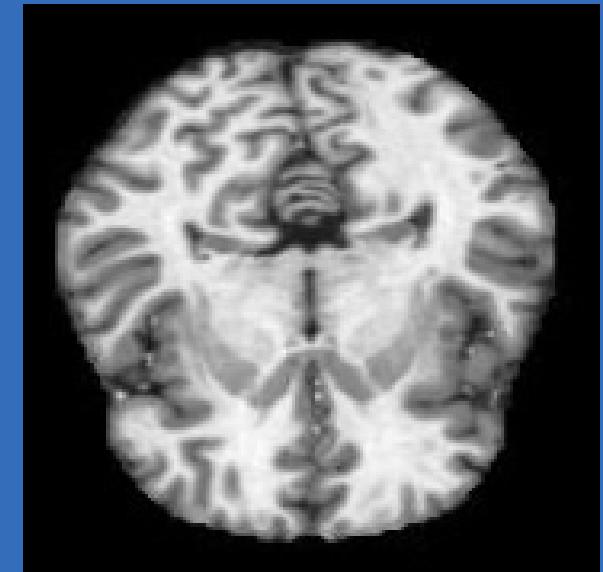
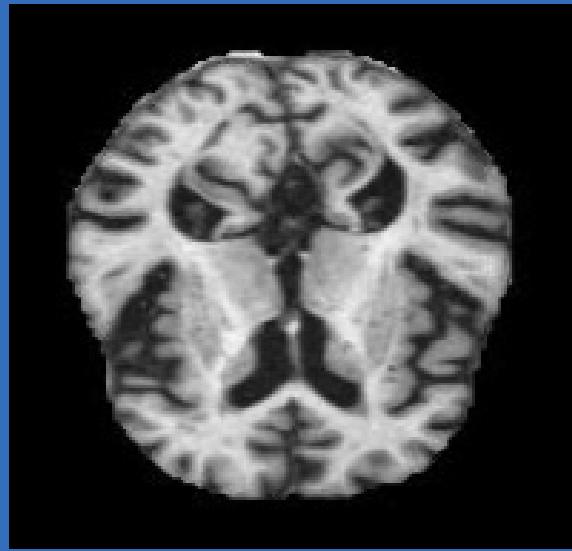


**Very Mild
Demented**

**Moderate
Demented**

**Mild
Demented**

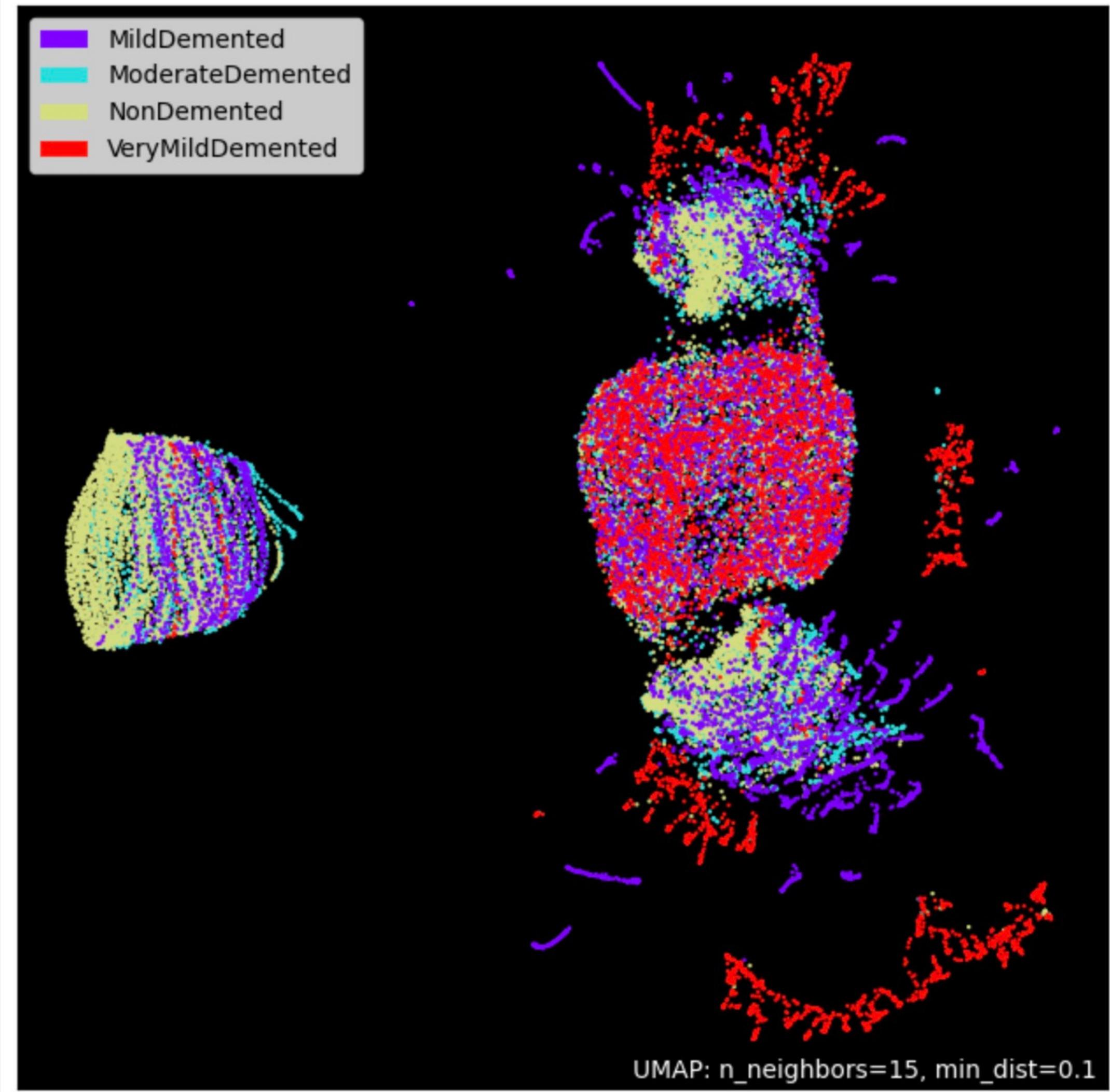
**Non
Demented**



34,000 Images Total

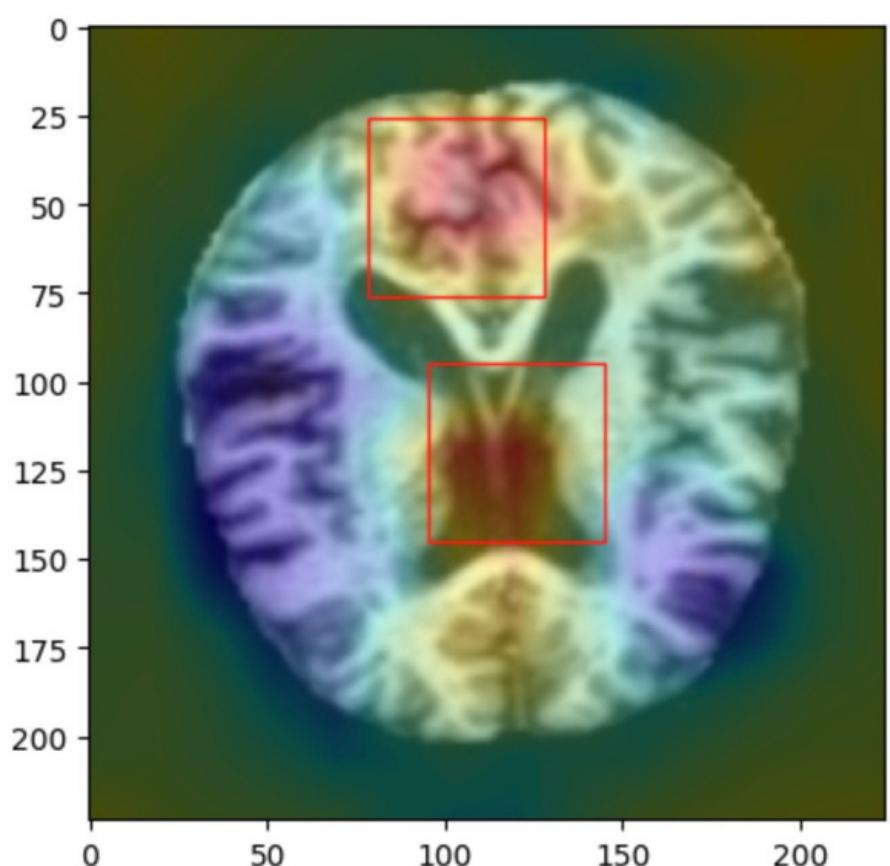
Umap of the Images

- Some of the classes are overlapping the others.
- The classes alone are not what is dividing the images
- There is some underlying feature that we cant see at the moment



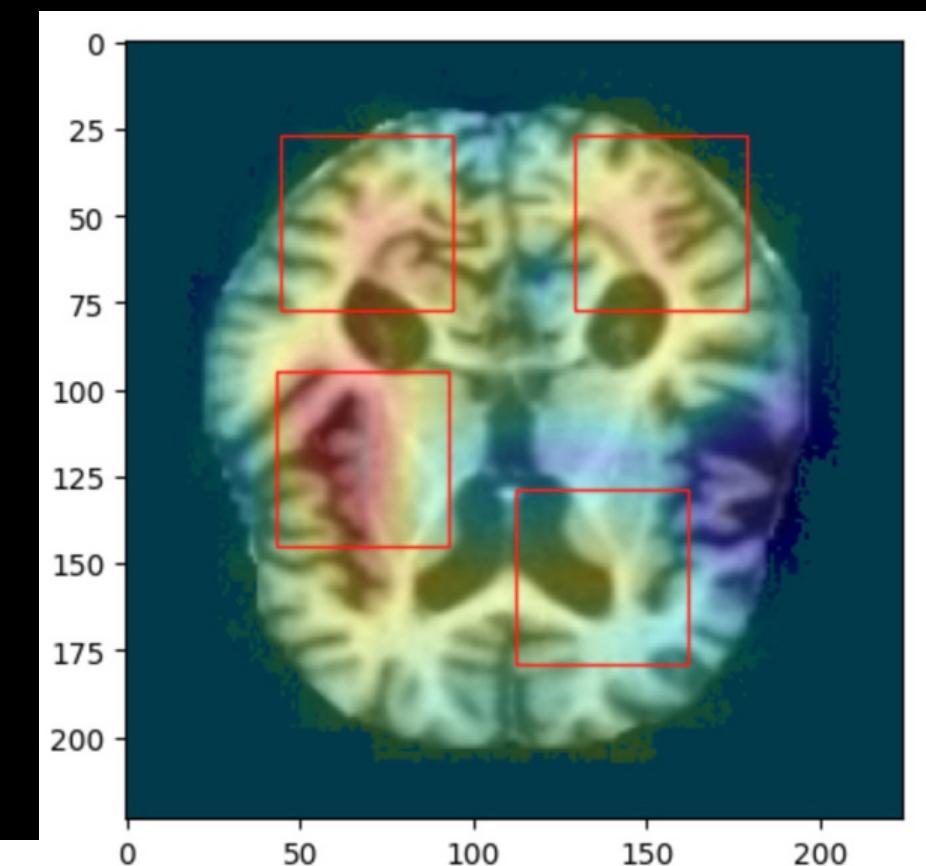
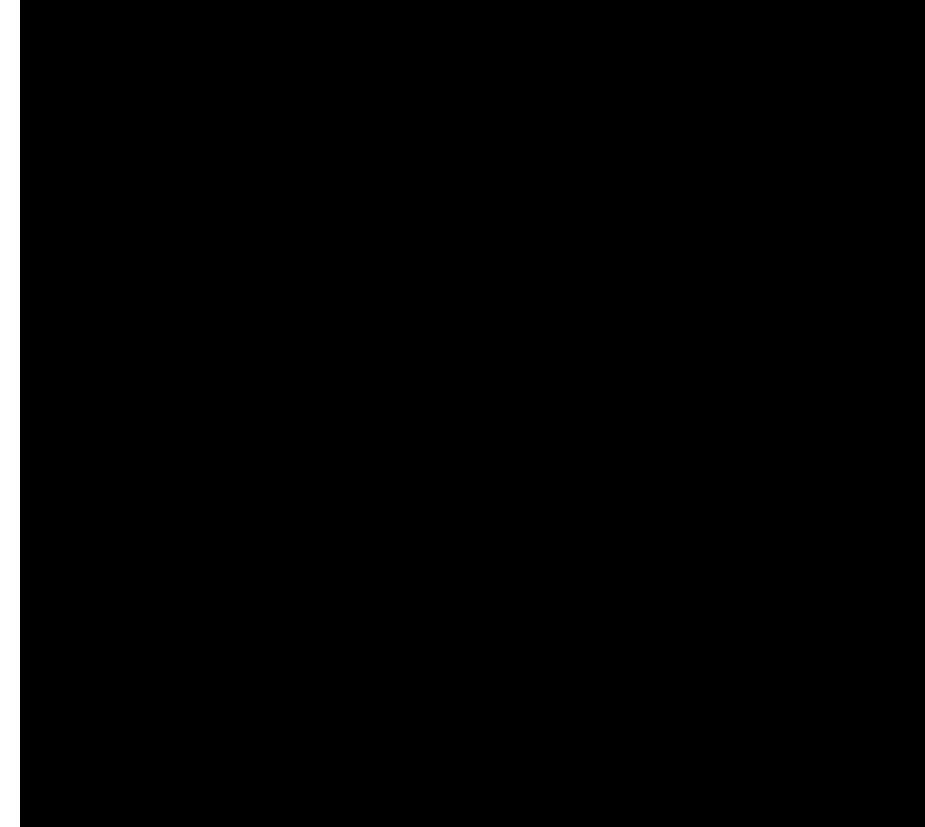
Uniform Manifold Approximation and Projection,
dimensionality reduction technique commonly used to reduce
high-dimensional data to a lower dimension, often to 2D or 3D

Anomaly Detection

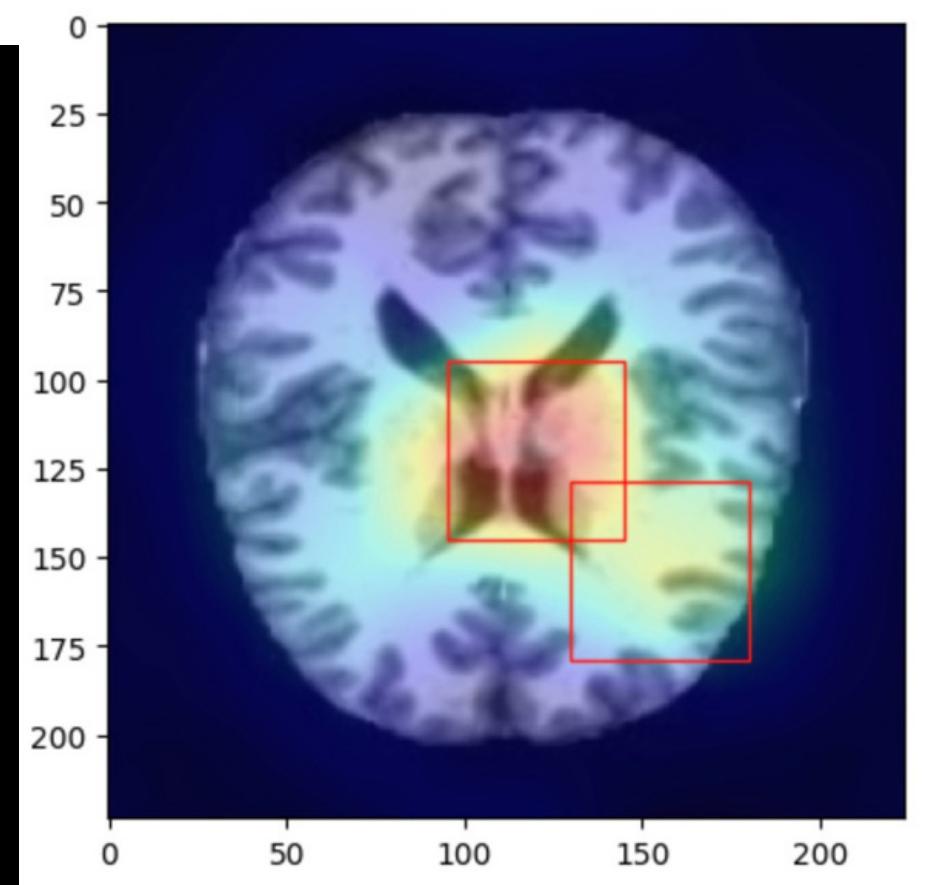


Mild Demented

- There are differences in the classes we can't detect

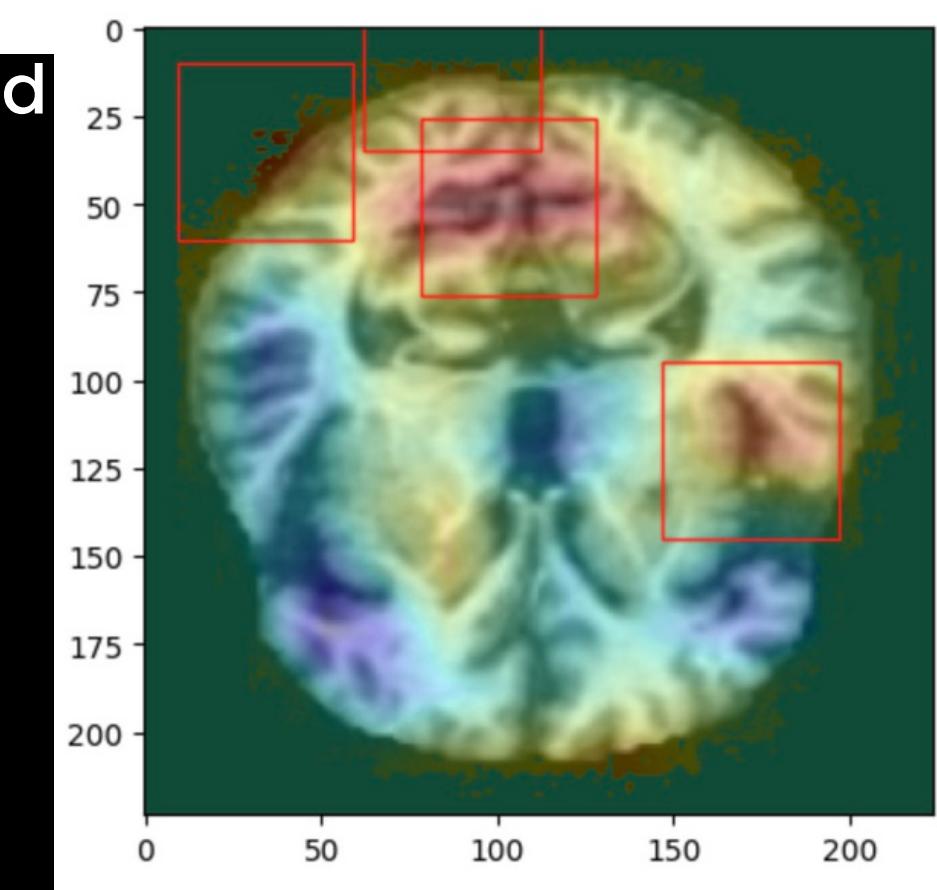


Moderate Demented



Non Demented

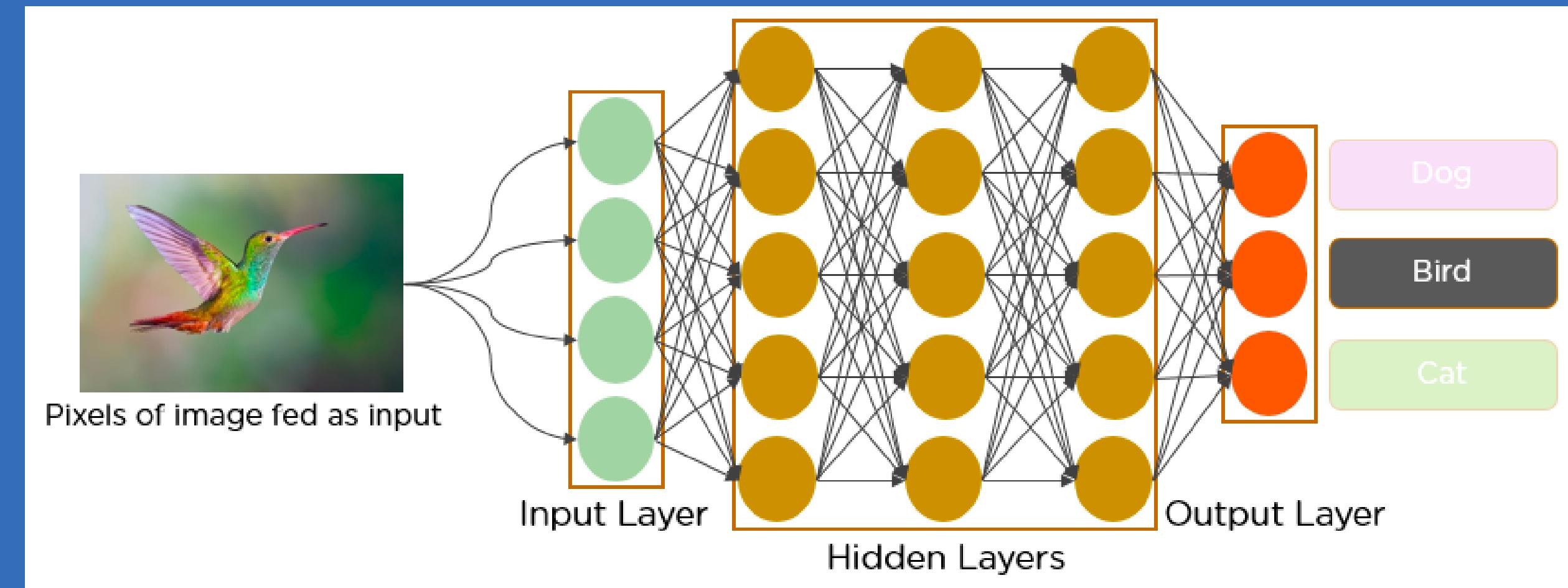
- Our Neural Networks need to be able to detect these anomalies



Very Mild Demented

Neural Network

A Series of algorithms that endeavour to recognize underlying relationship a set of data through a process that mimics the way the human brain operates



First demonstrated by a Cornell University psychologist Frank Rosenblatt in 1957

Models

3.

3 Different Models from Scratch
Creating 3 Neural Networks, improving
on each one

2.

2 Different Transfer Learning Models
GoogLeNet/Inception and ResNet50

1.

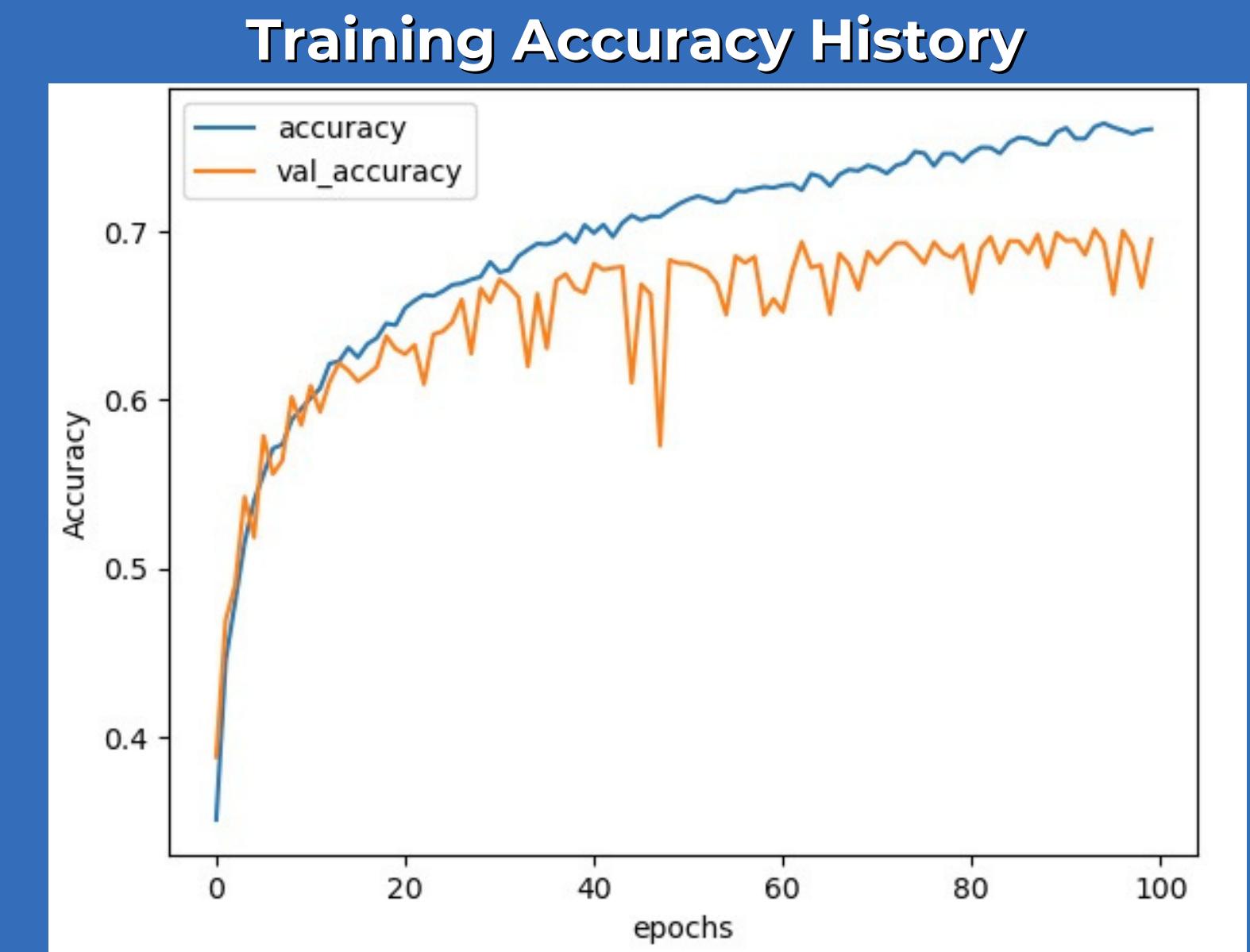
1 Keras Tuned Model



3 Models from Scratch

Version 1 - A simple model with 4 layers

- Performed Well
- Accuracy: 69%
- Extremely Prone to Overfitting



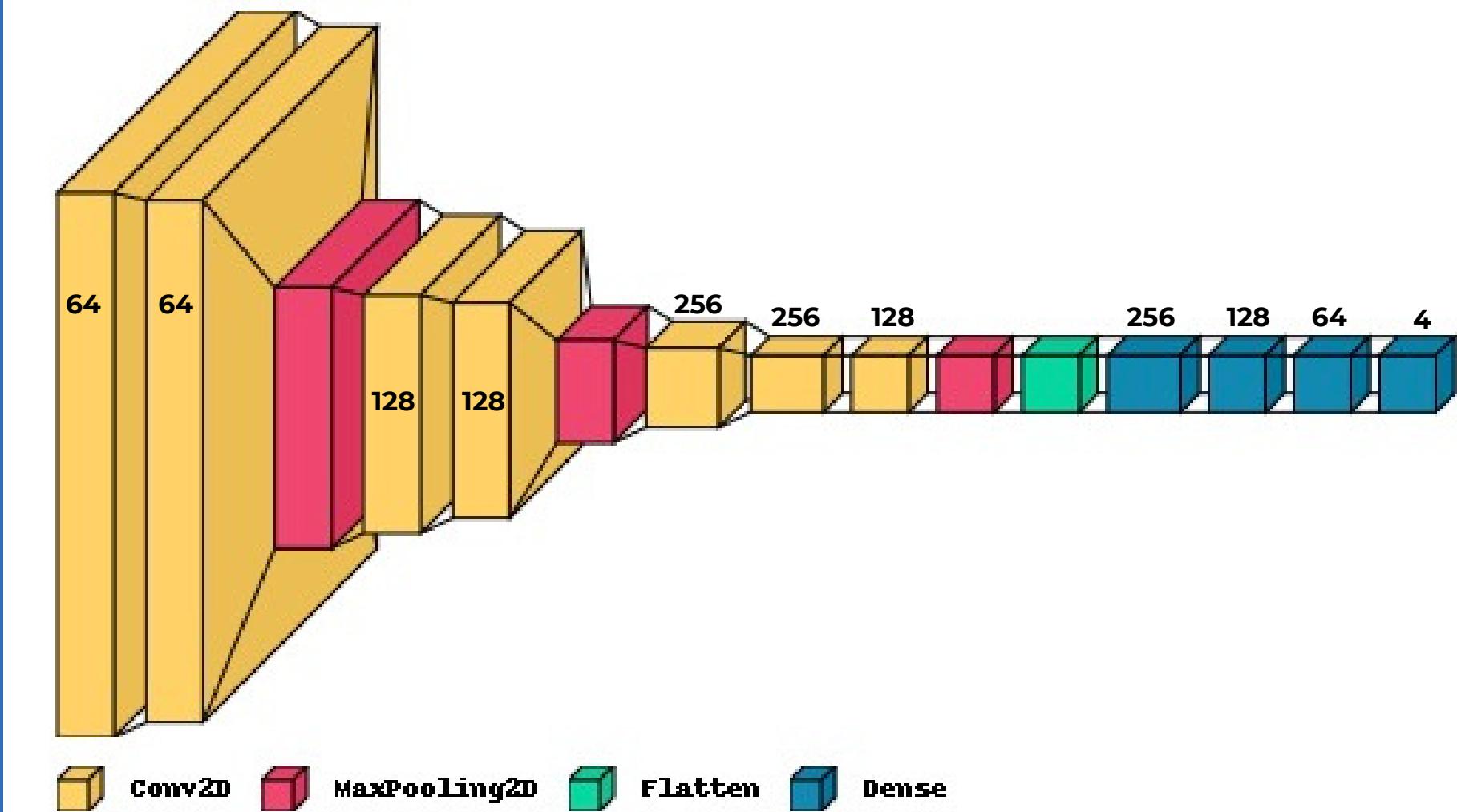
Is it Enough?



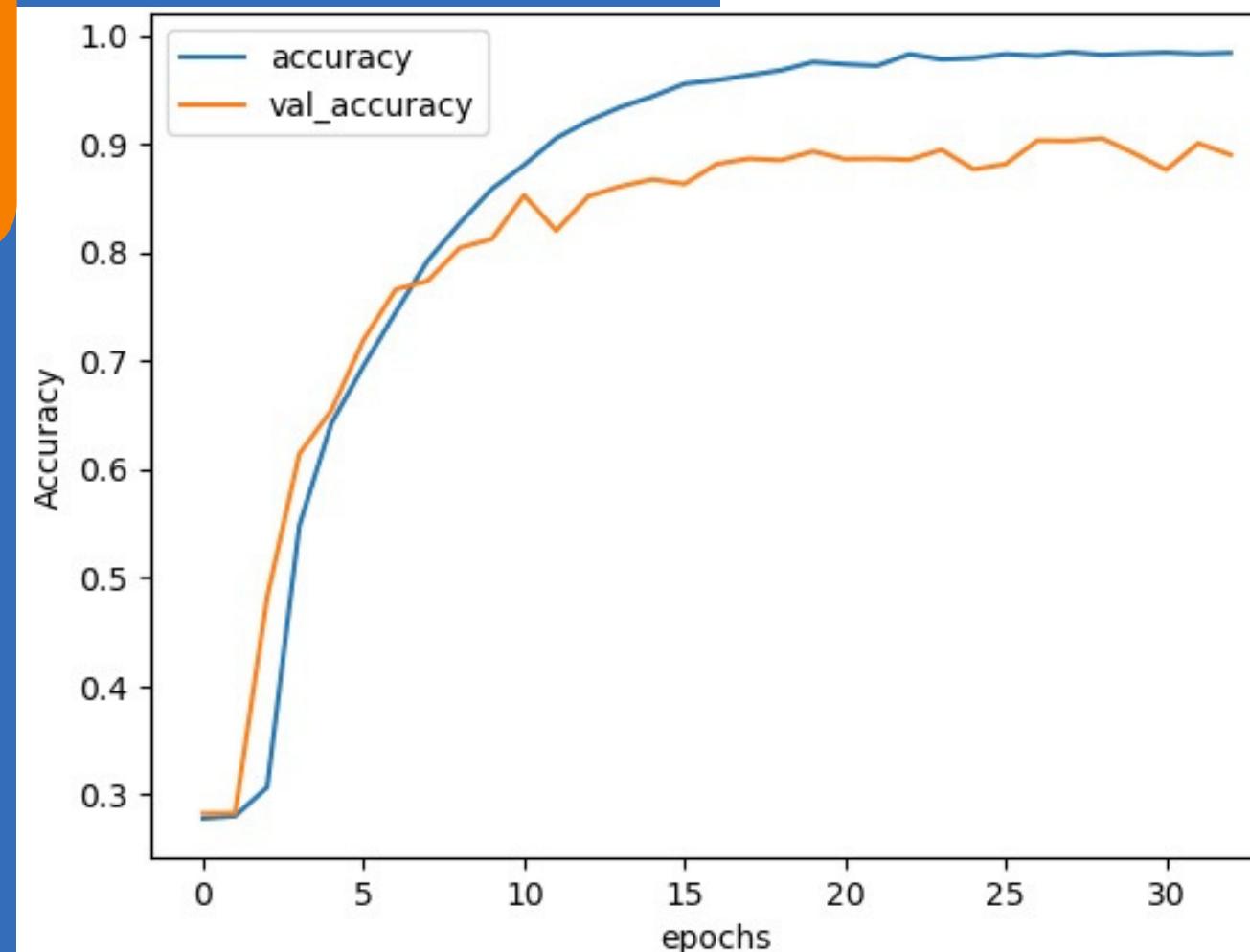
3 Models from Scratch

Version 2 - A Complex Model
Elements modeled from VGG16

- **Performed Better**
- **Accuracy: 89%**
- **Was still Overfitting**



Conv2D MaxPooling2D Flatten Dense

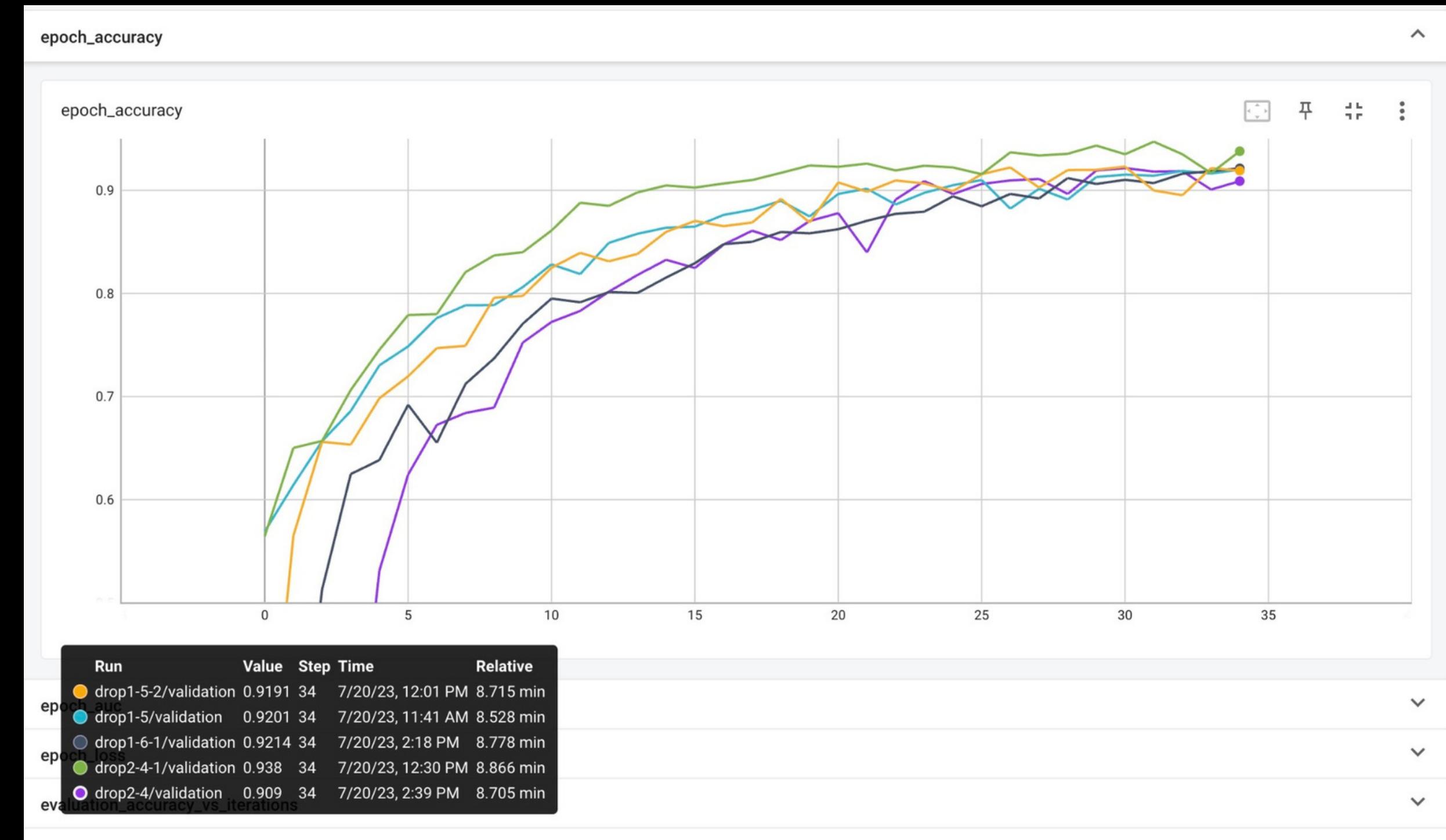


We Need to fight
the Overfitting

3 Models from Scratch

Version 3 - Same Architecture as V2, but with Regularization

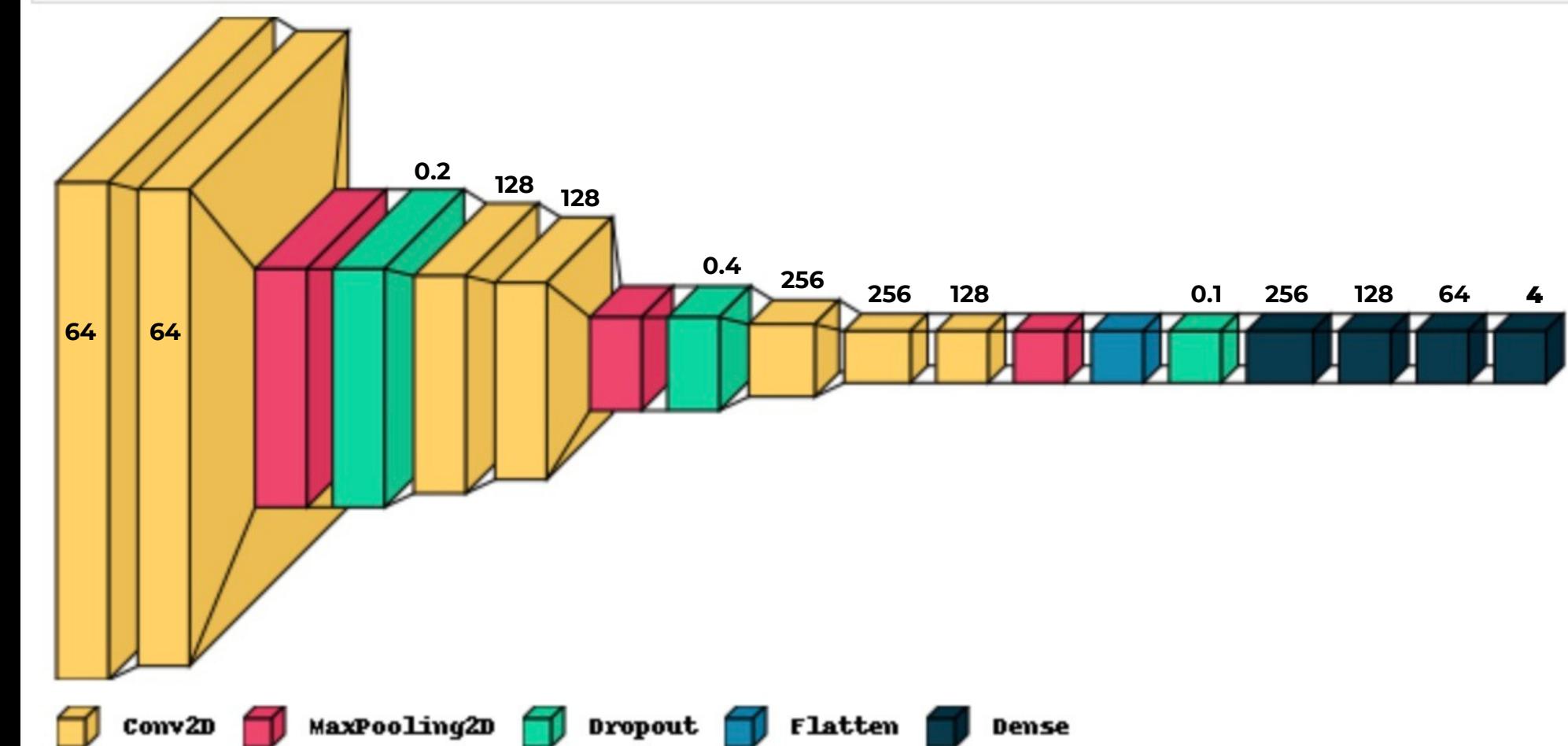
- Tensorboard Was Used to log the best Regularization method



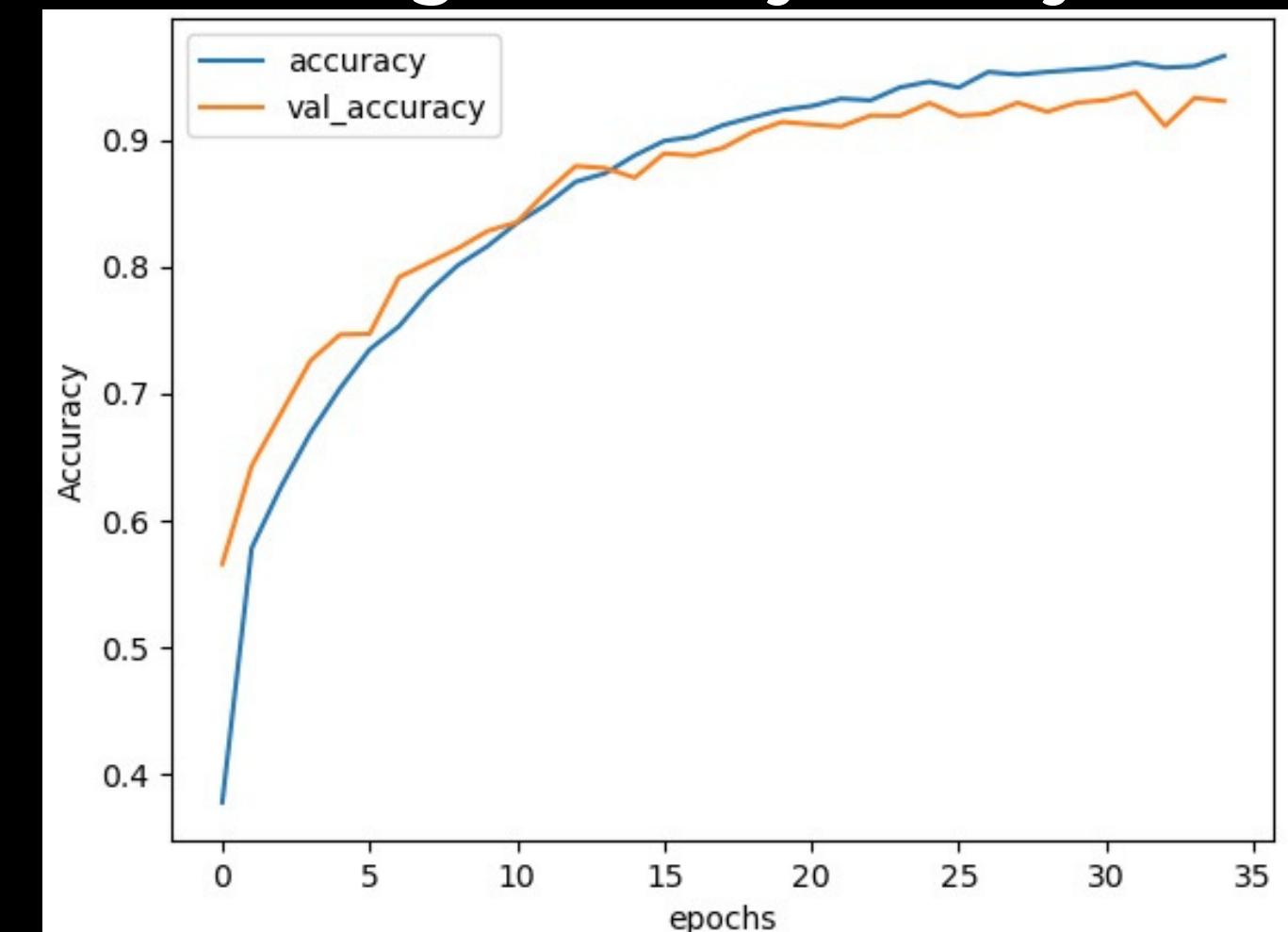
3 Models from Scratch

Version 3 - Same Architecture as V2, but with Regularization

- Performed The Best
- Accuracy: 93.41%



Training Accuracy History

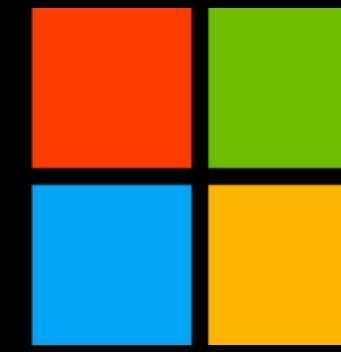


2 Transfer Learning Models



Inception Model

- Introduced by Google Research in 2014, it is also known as "GoogLeNet."



Microsoft

ResNet50 Model

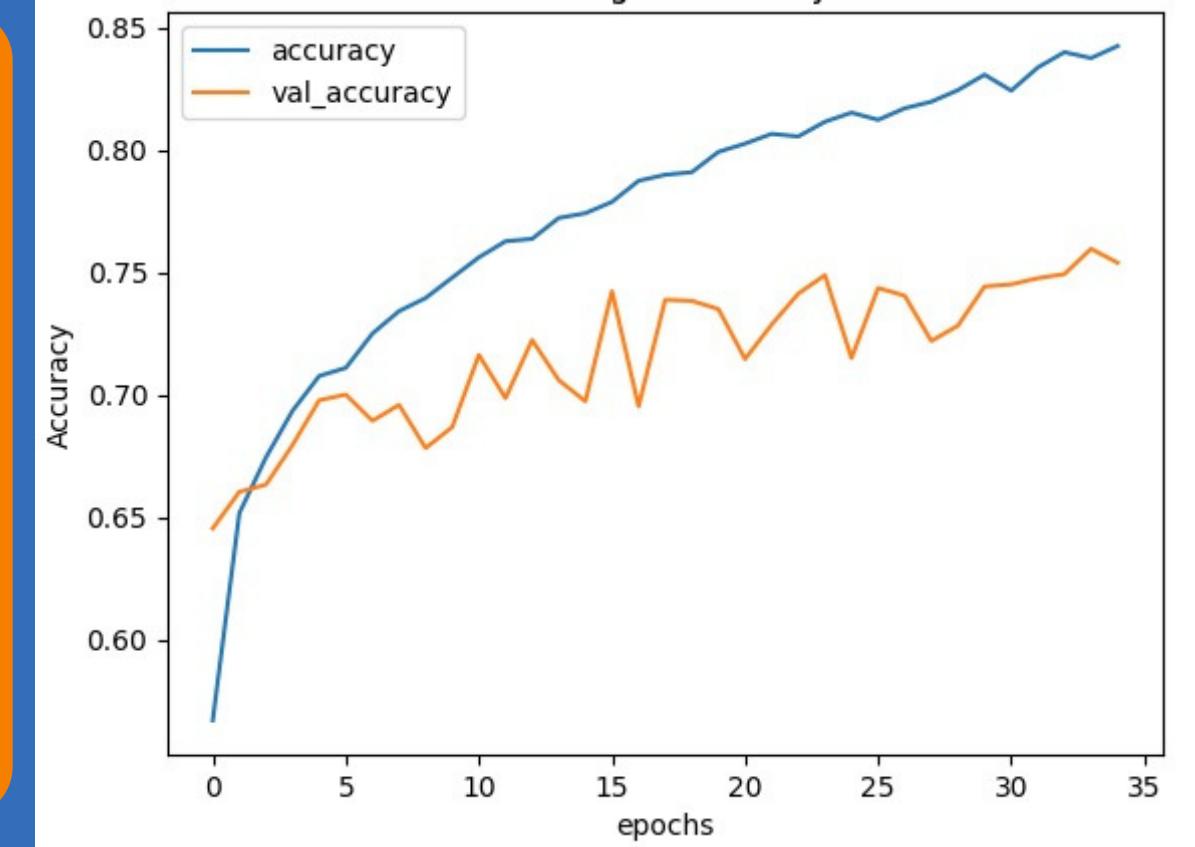
- A deep neural network architecture developed by Microsoft Research in 2015

The Inception V3

GoogLeNet - A Complex Model, Massive Architecture

- Performed Well
- Accuracy: 75.88%
- Was Overfitting
- Each Epoch took 19 mins

Training Accuracy History

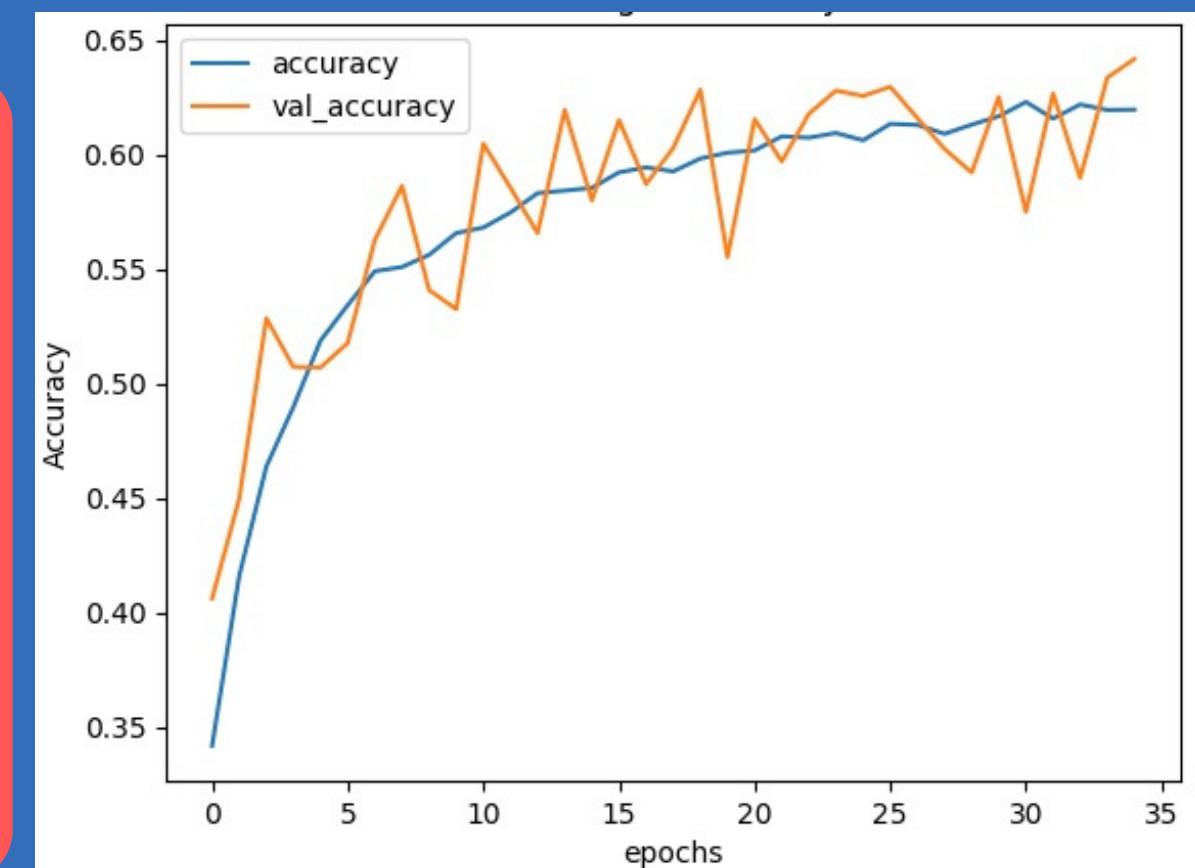


The ResNet50

ResNet50 - A Complex Model, 50 Layer Architecture

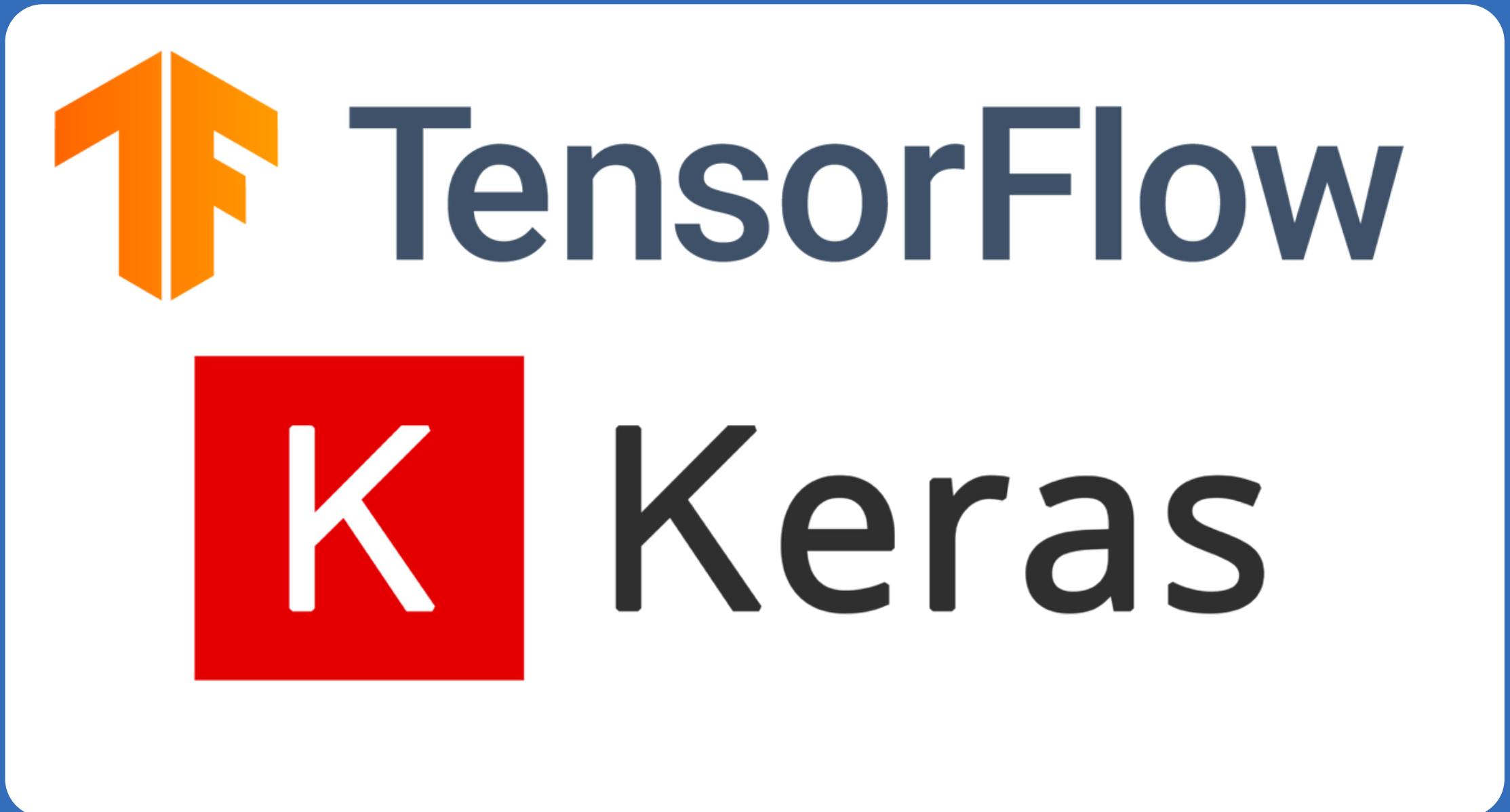
- Unsatisfactory Performance
- Accuracy: 63.83%
- Each Epoch took 38 mins

Training Accuracy History



1 Keras Tuned Models

- The Keras Tuner: A library that helps you pick the optimal set of hyperparameters for your TensorFlow program

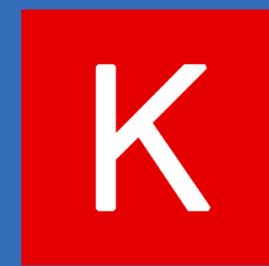


1 Keras Tuned Models

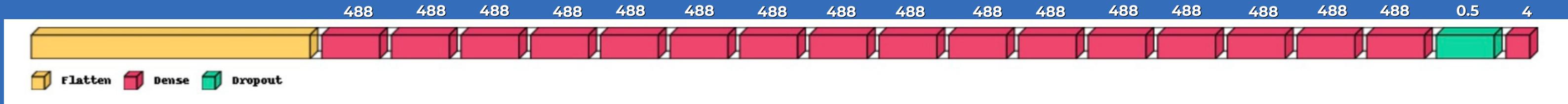
- Instantiate a Hyperband Tuning algorithm
- This is done using a sports championship-style bracket
- The algorithm trains a large number of models for a few epochs and carries forward only the top-performing half of the models to the next round



1 Keras Tuned Models



Keras



Accuracy: 80.55%

- Using For Loop, different models were created
- Min Layers: 2
- Max Layers: 20
- Each Layer with min Units: 8
- Each Layer with Max Unit: 512
- Increase each unit by 32

Best Model Accuracy

- Our Model from Scratch performed the best out of all model build

93%

v3

89%

v2

75%

80.55

- Even though the GoogLeNet was computationally expensive, it is the 3rd best model

- Our 2nd Best model is the Keras Tuner. If resources are put in it, it can preform better

Model V3



93.41%

Conclusion

Potential to contribute significantly to the early detection and diagnosis of Alzheimer's disease.

- Leading to improved patient outcomes
- Reduced healthcare costs.

Models and techniques developed can serve as valuable tools for medical professionals and researchers

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