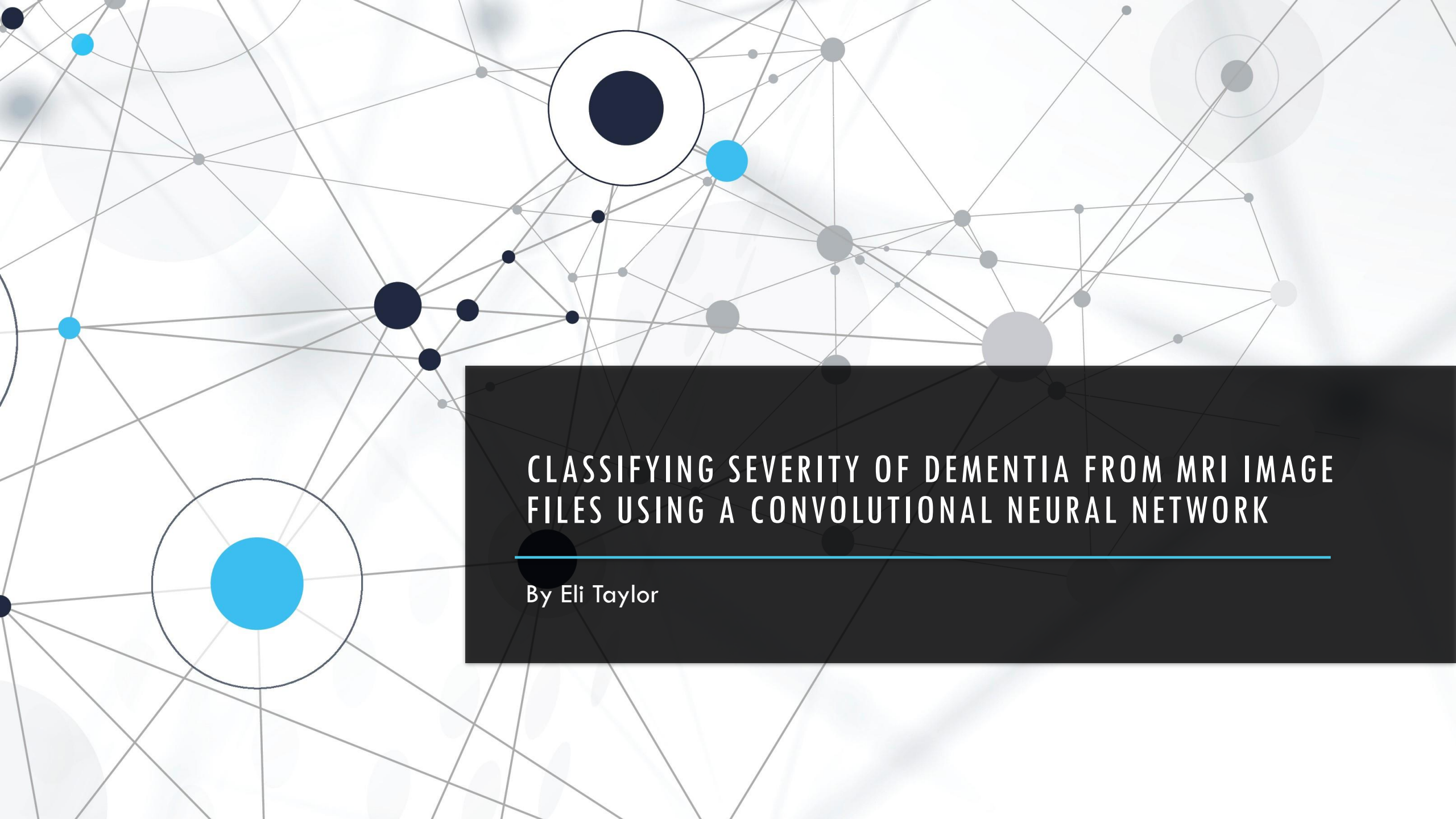


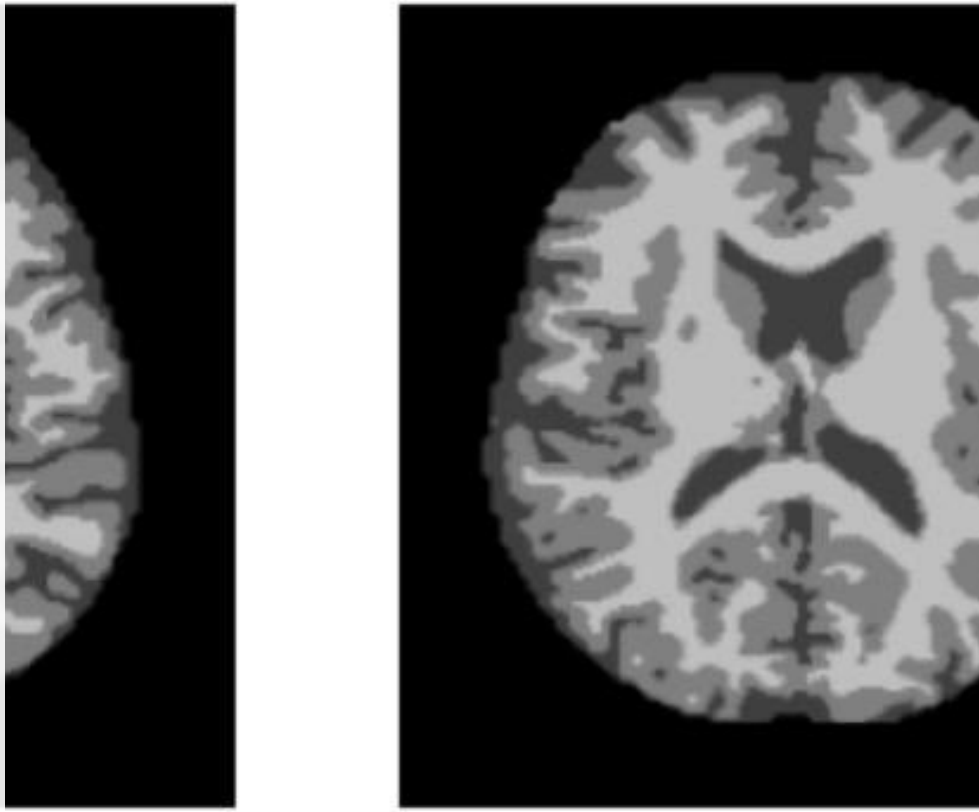
# CLASSIFYING SEVERITY OF DEMENTIA FROM MRI IMAGE FILES USING A CONVOLUTIONAL NEURAL NETWORK

By Eli Taylor

# INTRODUCTION

Eli Taylor is a Data Analyst, with 8 years of prior experience in the healthcare industry as an RN providing care for patients with memory impairment.

Areas of interest include computer vision and natural language processing, particularly involving novel applications for AI/ML in the healthcare sector and leveraging the power of technology to solve real-world challenges.

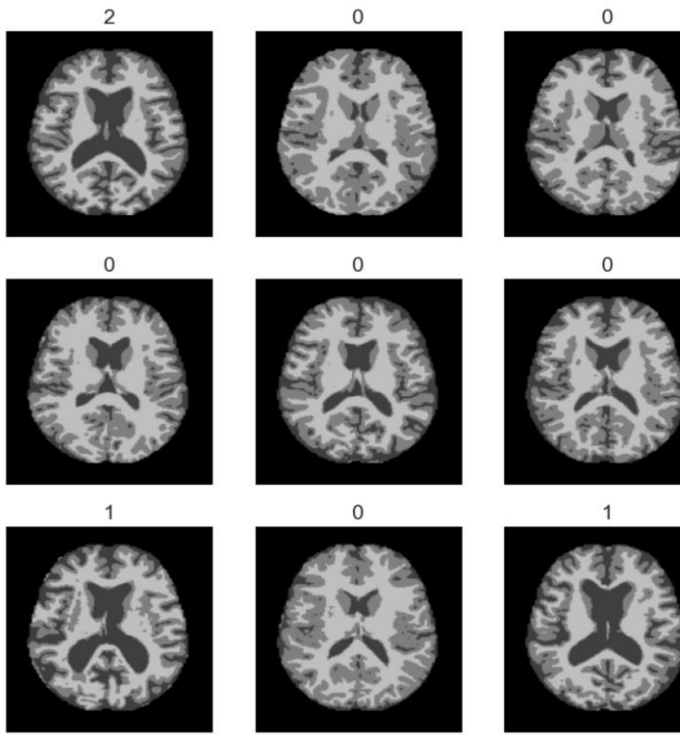


# RESEARCH QUESTION

**Problem:** The increasing prevalence of dementia is a global health issue that affects quality of life and places a massive strain on both healthcare systems and local communities.

**Research Question:** Can a neural network accurately classify MRI images based on dementia severity?

**Hypothesis:** Brain MRI images contain observable features that can be used to train a neural network to classify patients based on dementia severity with 90% accuracy.




# DATA ANALYSIS

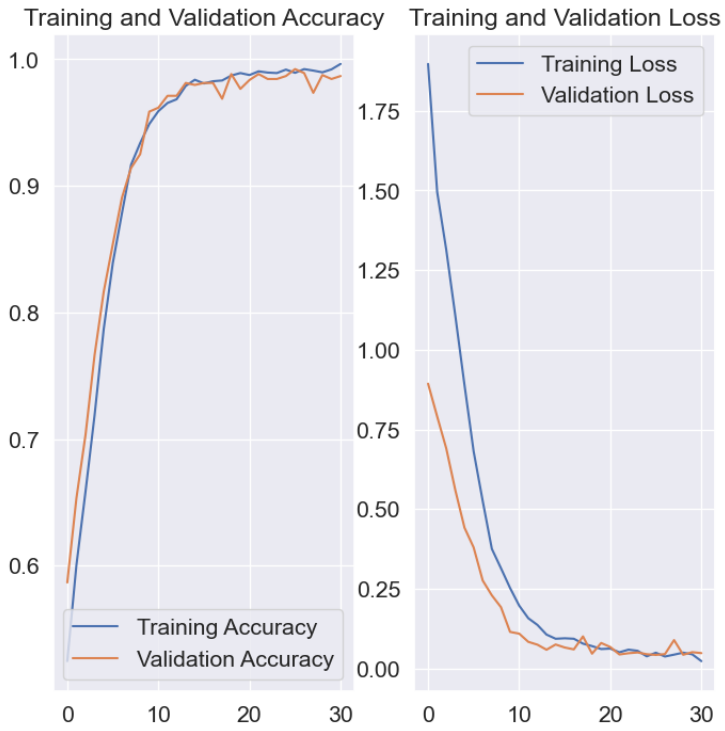
Convolutional Neural Networks are the preferred type of neural network for handling image classification tasks.

ReLU activation is an excellent choice for most model layers.

Pooling and dropout layers help reduce overfitting.

Sample weights are added to address unbalanced datasets.

A Softmax activation in the output layer is used for classification tasks with more than 2 classes.




The OASIS-1 model achieved a maximum accuracy of 78.16% on the validation data. With the use of the larger Kaggle dataset, the model achieved 98.67% accuracy!

Data quality makes a big difference in achieving accurate results. Large amounts of data are needed to train neural networks.

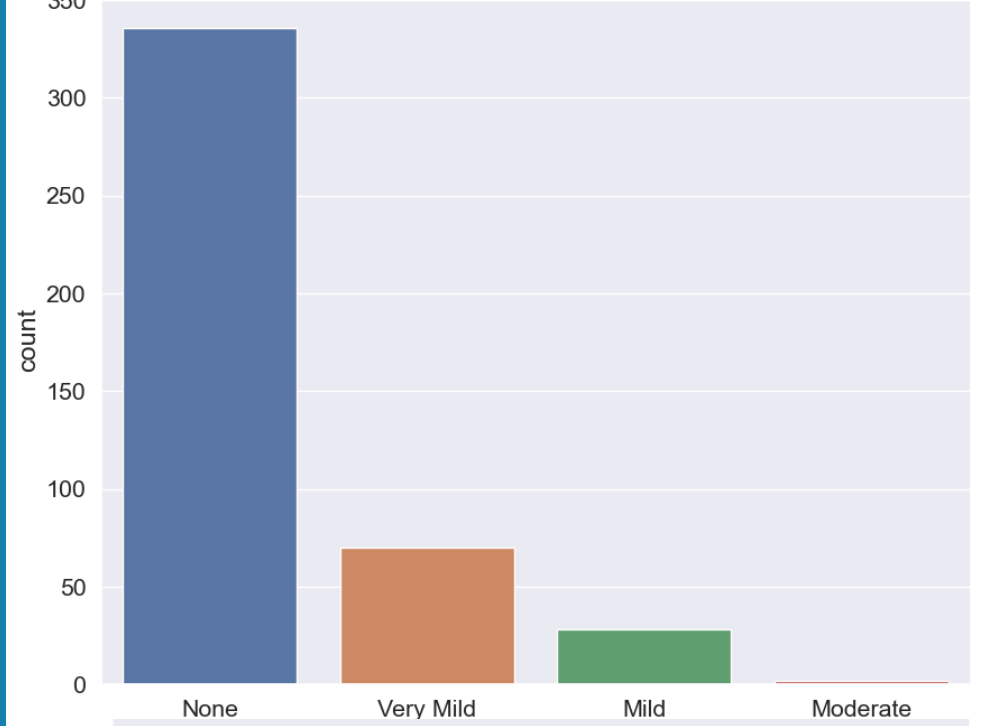
Accuracy and loss are very similar for both the training and validation data, showing that the model is neither overfitting nor underfitting.

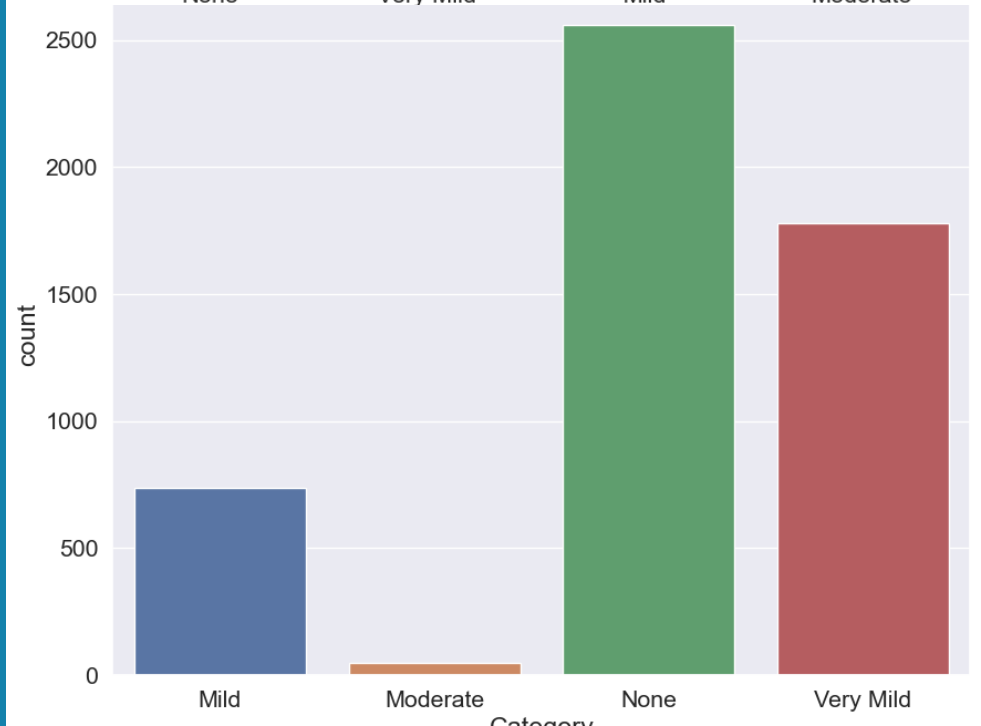
# FINDINGS

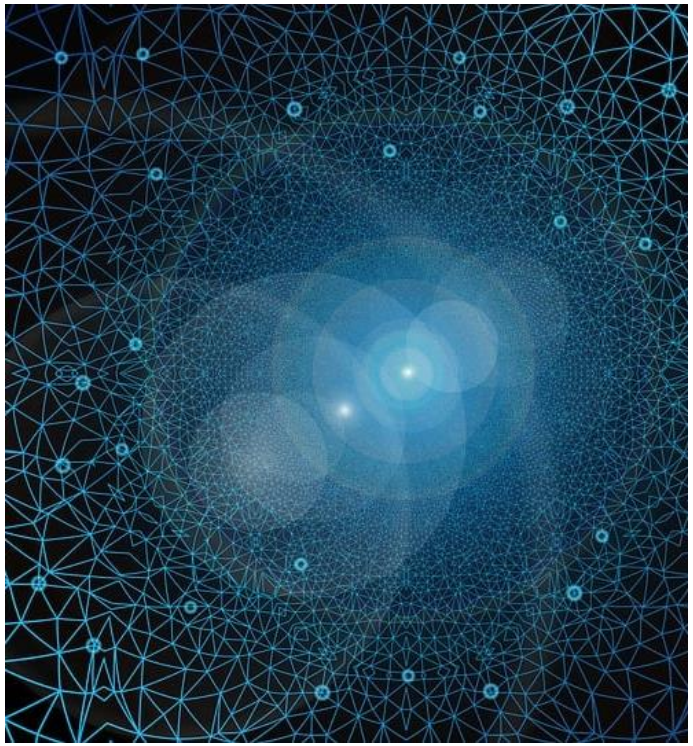
# LIMITATIONS

The OASIS-1 dataset is a relatively small set of 436 MRI images. The dataset is unbalanced, with only two samples labelled as moderate dementia and only 28 samples labelled as mild dementia.

The Kaggle dataset is much larger with 6400, but the classes are still unbalanced. The model will likely have more difficulty classifying samples with mild to moderate dementia.





# RECOMMENDATIONS

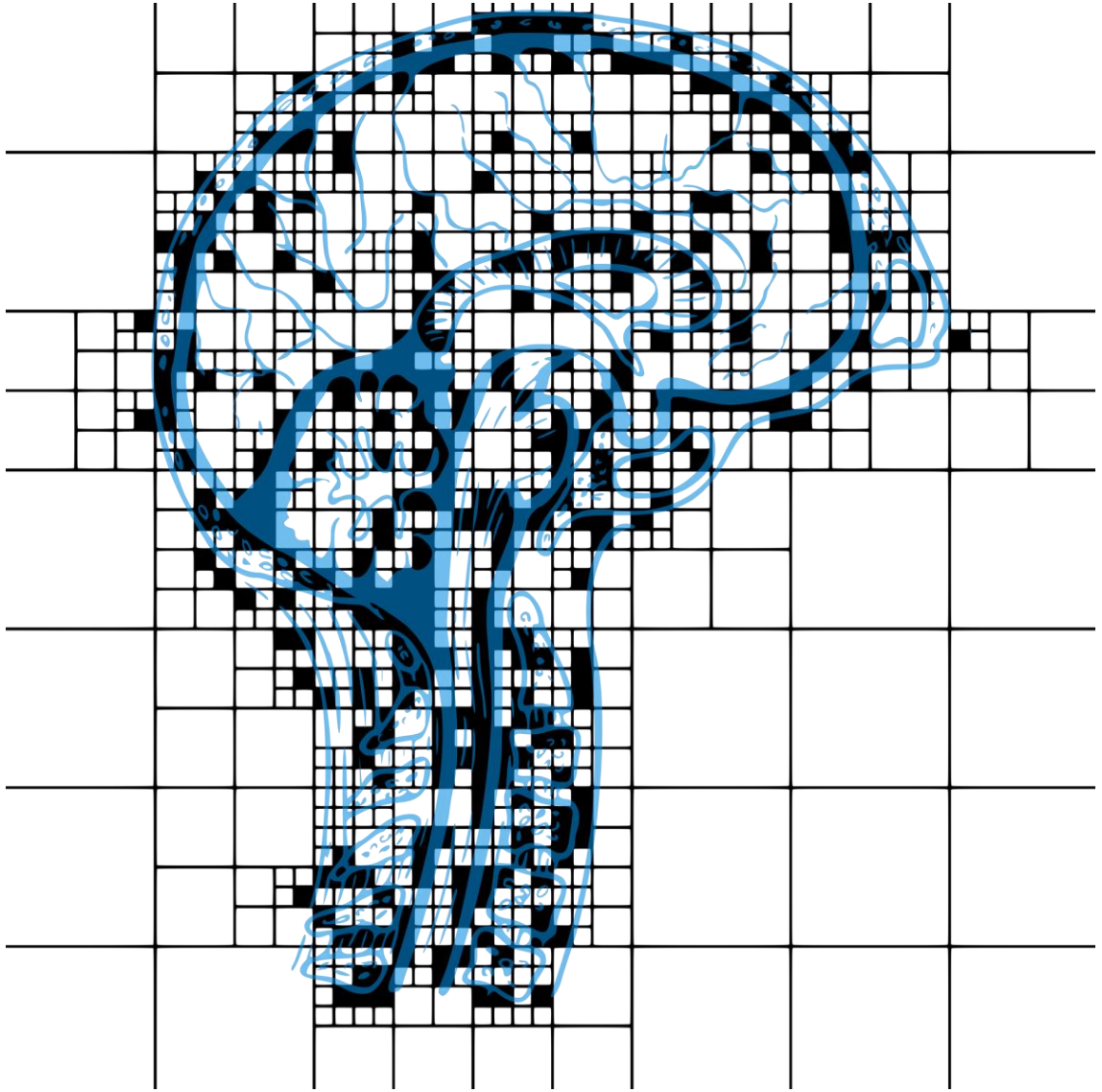
Improve model accuracy by:

1. Obtaining additional MRI image data, particularly for subjects with mild or moderate dementia,

2. Considering use of transfer learning with networks such as ResNet or AlexNet that have been trained on vast amounts of image data.

# CONCLUSION

Tools for early diagnosis and intervention for dementia have been a growing area of research interest in recent years. With an estimated 10 million new cases of dementia being diagnosed globally every year, methods of cost-effective, efficient, and accurate diagnosis will be crucial in providing care to this patient population (WHO, 2023).



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