

# Early Alzheimer's Detection

Deep Learning on OASIS MRI Images

# Questions Sought to Answer

Can a CNN-based model classify MRI scans into four Alzheimer's stages: non-demented, very mild, mild, and moderate dementia?

How effective is multi-class classification in detecting early disease stages?

# Data Preparation

Dataset: OASIS MRI dataset

86,000 images from 461 patients

Classes: Non-Demented, Very Mild Dementia, Mild Dementia, Moderate Dementia

Preprocessing

Resizing images to 128x128 pixels

Normalizing pixel intensity to [0, 1]

Class weighting for imbalance

Stratified splits for training/validation/testing

# Techniques and Tools

## Tools

Python, TensorFlow/Keras

Github

## Techniques

Transfer learning with VGG16

Class weighting and stratification

Grad-CAM for visualizations

Optimizer: Adam; Loss Function: Categorical Cross-Entropy

Regularization: Dropout and Early Stopping

# Results

Overall Accuracy: 89%

Class-Specific Performance:

Non-Demented: Precision 92%, Recall 94%

Very Mild Dementia: Precision 85%, Recall 82%

Mild Dementia: Precision 78%, Recall 75%

Moderate Dementia: Precision 65%, Recall 60%

Insights

High performance in early-stage detection

Challenges in distinguishing mild vs moderate dementia

# Knowledge Gained

Deep learning models can classify Alzheimer's stages effectively

Early detection, particularly for very mild dementia, is feasible

Grad-CAM visualizations enhance interpretability and relevance

# Applications

Clinical Decision Support: Early warning for radiologists

Personalized Patient Monitoring: Track disease progression

Enhancing Clinical Trials: Better participant selection

Healthcare Resource Allocation: Stratify follow-ups and care

Integration with Multimodal Data: Combining MRI with other diagnostics

# Conclusion

Achieved nuanced classification beyond binary frameworks

Demonstrated clinical potential for early Alzheimer's detection

Future Directions:

- Explore 3D CNNs and advanced architectures

- Integrate multimodal data

- Address class imbalance for better performance