An Empirical Study of Decision Tree Variants on Alzheimer's MRI Dataset

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Outline

Introduction

- Alzheimer's disease (AD) is a progressive neurodegenerative disorder.
- Early diagnosis using MRI can help in treatment planning.
- This study explores different Decision Tree (DT) variants for classifying AD stages.

Related Work

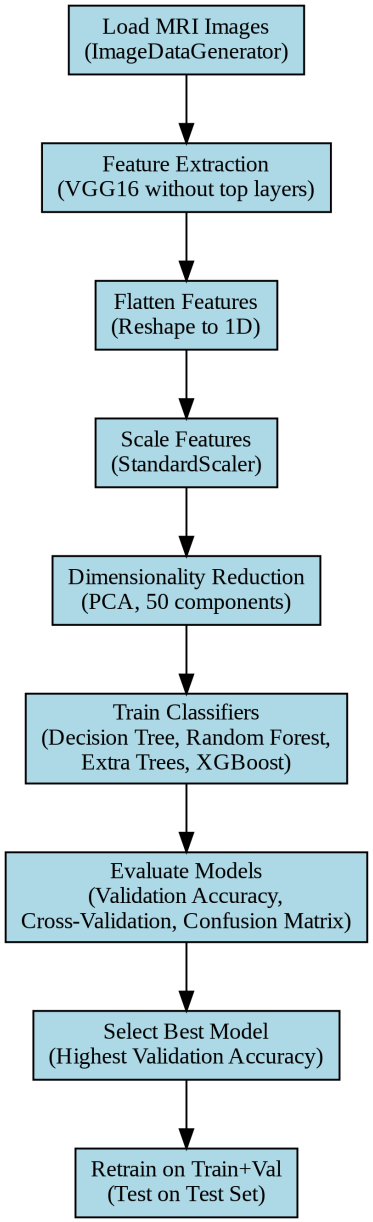
- Residual CNNs have been used for 3D MRI classification [Korolev et al., 2017].
- Hybrid deep learning models improve interpretability [Wang et al., 2022].
- Ensemble learning like EfficientNet shows high accuracy [Mehta et al., 2021].

Dataset

- Sourced from Kaggle: **"Best Alzheimer MRI Dataset 99% Accuracy"** by Luke Chugh[1]
- Contains pre-processed, T1-weighted MRI images
- Images are categorized into four cognitive classes:
  - No Impairment
  - Very Mild Impairment
  - Mild Impairment
  - Moderate Impairment

[1] `https://www.kaggle.com/datasets/lukechugh/best-alzheimer-mri-dataset-99-accuracy`

Pipeline Overview



Decision Tree Variants

- Standard Decision Tree (CART)
- Random Forest
- Extra Trees
- XGBoost

Evaluation Metrics

- Accuracy
- Precision, Recall, F1-Score
- Confusion Matrix
- ROC-AUC Score

Experimental Results

Model	Accuracy	F1-Score	AUC
Decision Tree	81.2%	0.79	0.83
Random Forest	88.5%	0.87	0.90
Extra Trees	89.1%	0.88	0.91
XGBoost	90.3%	0.89	0.92

Table: Performance Comparison

Conclusion

- XGBoost outperformed all other DT variants.
- MRI-based classification is promising for AD detection.
- Ensemble methods improve prediction performance.

Future Work

- Include deep learning models for comparison.
- Utilize 3D MRI data and clinical features.
- Explore explainability and interpretability of models.

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Questions?