Analysis of Alzheimer's Disease using Supervised ML Algorithms

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Introduction

AD is a severe disorder which affects gradually in the brain and cannot be undone. This is a deadly disease which affects our memory and social interaction ability which means it affects the cognitive function of our brain. This hampers our daily life in a negative way. The symptoms of this disease is slight loss of memory and gradually destroys the cognitive function of our brain. The downside of this disease is that there is no cure yet to be found. However, some medications and habit changes can improve the quality of life under medical supervision. World Health Organization reported that there about around 55 million patients who

Literature Review

- Shankle et al.
- Alvarez et al.
- Escudero et al.
- Hyunseokc
- Al-Shoukry et al.,
- Eke et al.

Dataset

- Dataset is taken from the famous Open Access Series of Imaging Studies (OASIS) website.
- Two dataset files contains some pre-determining factors such as MMSE, eTIV, ASF etc.
- We omit some unwanted features from our dataset such as OASIS_ID, MRI_ID etc.

FEATURE DESCRIPTION OF THE DATASET

Feature Name	Feature Description
Gender	Gender of the individual
Age	Age of the individual
Educ	Years of education
SES	Socioeconomic status
MMSE	Mini-Mental State Examination (MMSE) score
CDR	Clinical Dementia Rating (CDR)
eTIV	Estimated total intracranial volume
nWVB	normalized whole-brain volume
ASF	Atlas Scaling Factor

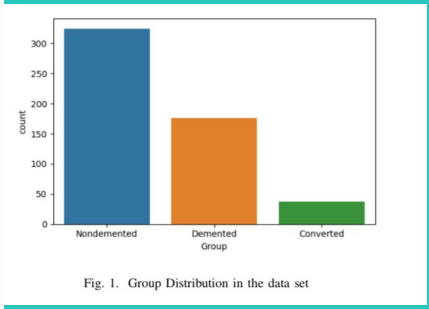


Fig. 1. Group Distribution in the data set

Fig. 2. Genderwise Group Distribution in the dataset

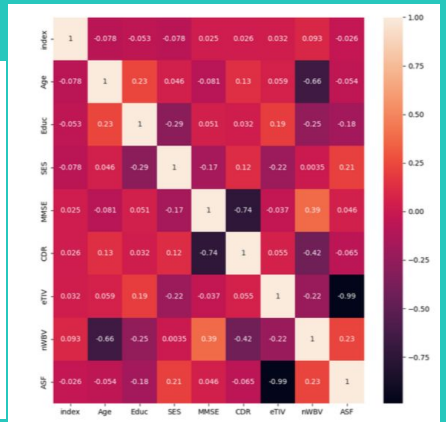
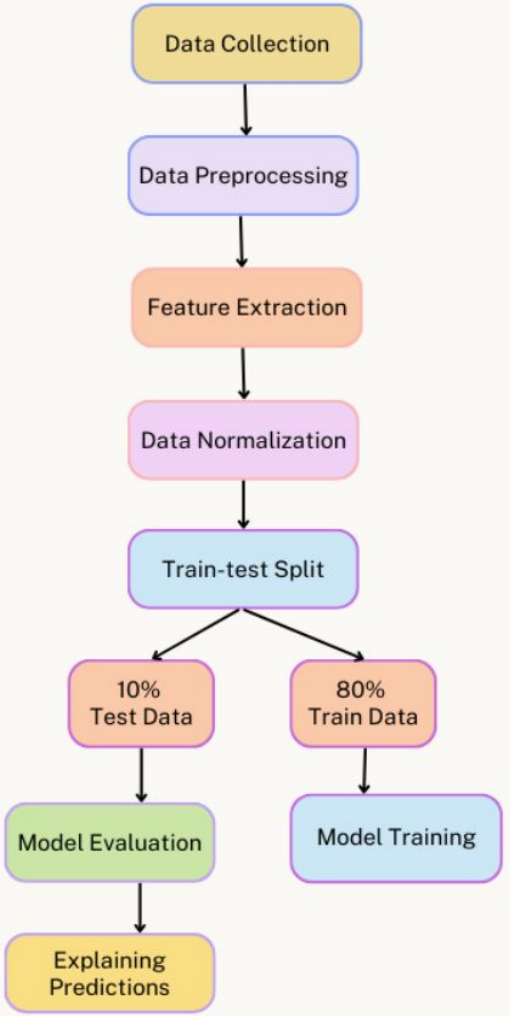


Fig. 3. Correlation heatmap

Proposed Methodology

- Data Collection
- Data Preprocessing
- Feature Extraction
- Data Normalization
- Splitting
- Model Training



Model Training

- Logistic Regression
- Random Forest
- Gradient Boosting
- SVM
- AdaBoost
- XGBoost
- KNN
- Voting Classifier(Hard)
- Voting Classifier(Soft)
- Gaussian NB

Result Analysis

- Random Forest has the highest results
- Bagging methods performed better than boosting algorithms
- Linear Classifiers performed less in this comparison
- Used LIME to find out why RF performed well.

Model	Recall (ND)	Recall (D)	Accuracy
Random Forest	**100%**	**100%**	**100%**
Logistic Regression	98%	90%	93%
KNN	96%	93%	90%
Gaussian NB	90%	93%	96%
SVM	100%	89%	91%
XGBoost	100%	96%	96%
AdaBoost	97%	99%	90%
Gradient Boosting	99%	95%	91%
Voting Classifier(Hard)	89%	99%	94%
Voting Classifier(Soft)	94%	92%	93%

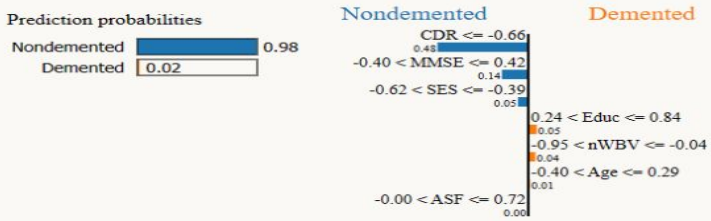


Fig. 5. A Patient Correctly Classified as Nondemented

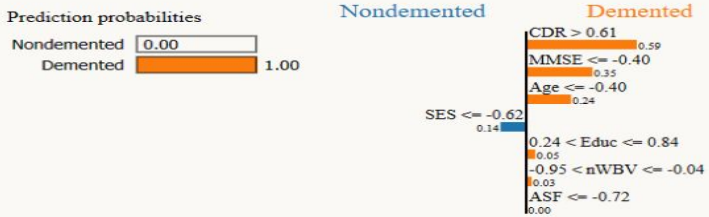


Fig. 6. A Patient Correctly Classified as Nondemented

Challenges

- ➔ Nature of Data
- ➔ Model Interpretability
- ➔ Model Explainability
- ➔ Model Integration
- ➔ Ethical Considerations

Conclusion

ML algorithms are capable of analyzing large datasets to identify patterns and associations that can be used to predict AD risk and progression. However, the development and implementation of ML-based AD detection tools face several challenges and these challenges should be properly addressed

References

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