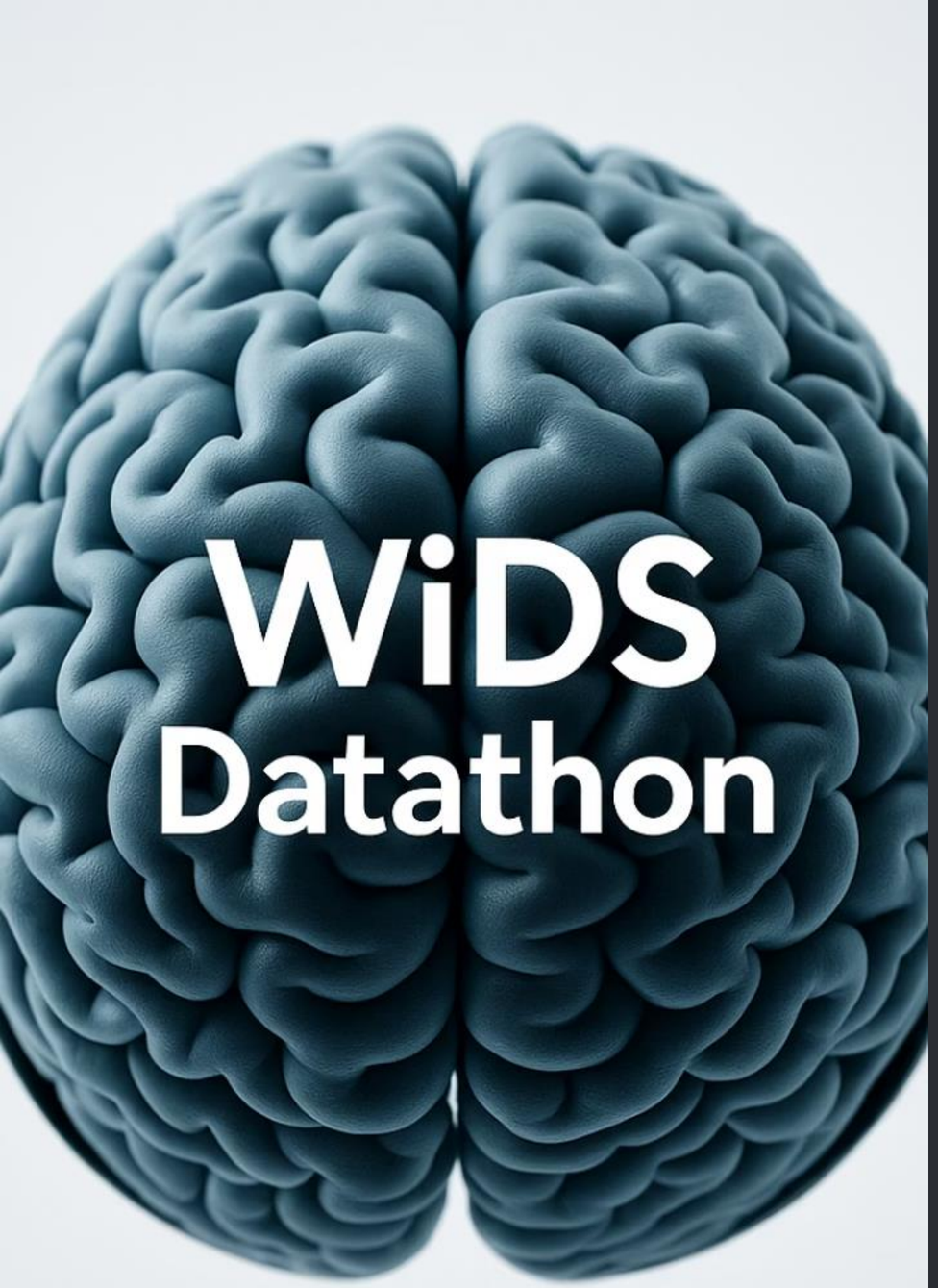


ML-Powered ADHD Predictor

Sex-Specific Brain Connectivity Patterns for ADHD Prediction using Machine Learning

Presenter:

Kunal Prasad | BCA | CSIT |

Final Year PPT, Guru Ghasidas Vishwavidyalaya | May 2025 |

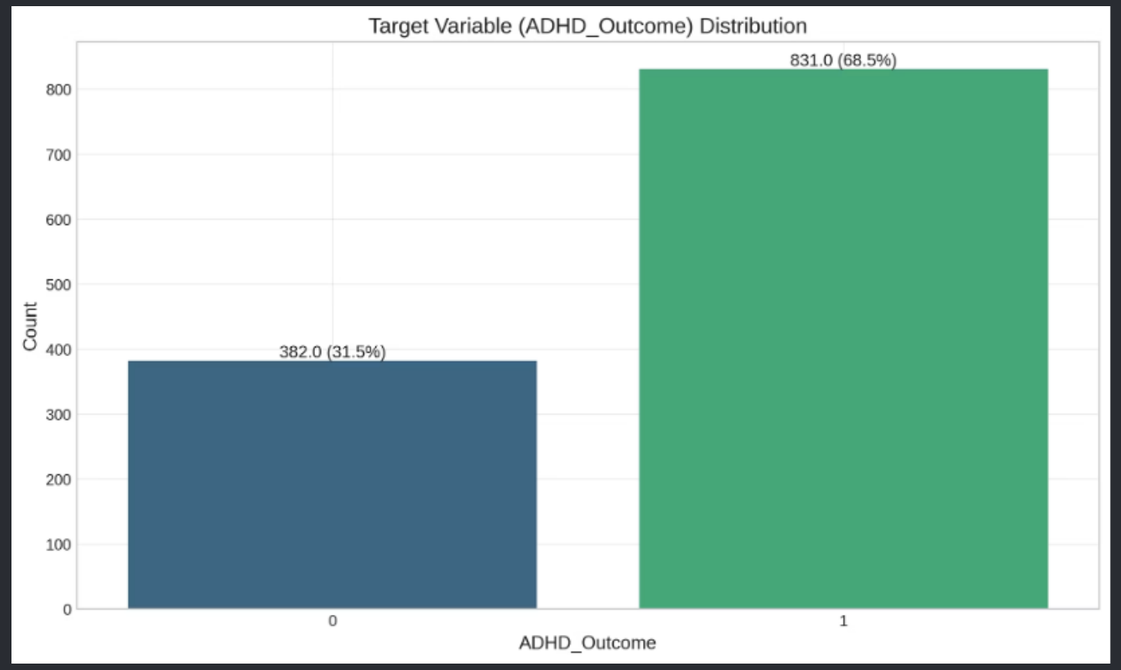
ADHD and Research Context

ADHD Prevalence

- **11% adolescents affected**
- **14% boys, 8% girls**
- **Females often underdiagnosed**

WiDS Datathon 2025

Using fMRI and ML to address diagnostic gaps



Dataset Overview

Source

Healthy Brain Network (HBN)

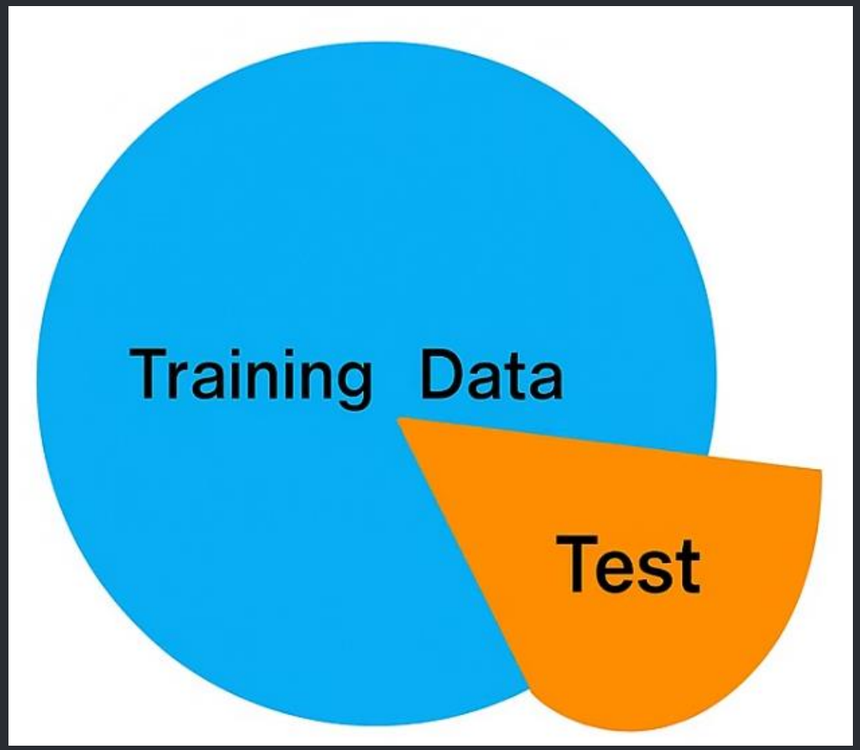
Data

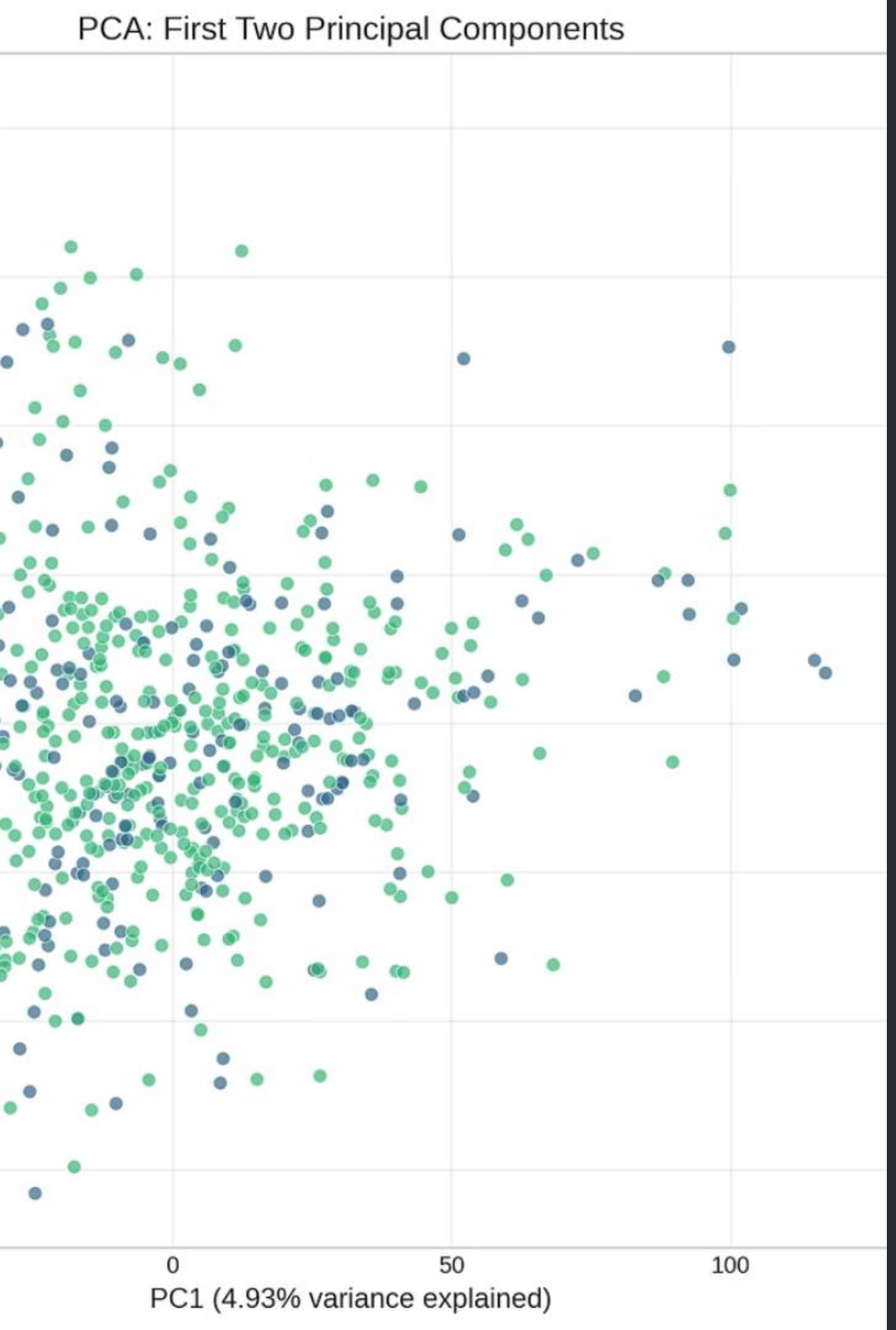
- **fMRI connectomes: 36x36 matrices, 630 features**
- **Metadata: Age, SDQ scores, parent education**

row	1213
columns	19931

Subjects

~1,200 train; ~300 test





Data Preprocessing

fMRI

PCA with ~50 components, 95% variance

Metadata

Interaction terms, median imputation

Exploratory Data Analysis

14% ADHD males, 8% females; SDQ_Hyperactivity r=0.42

Data → Preprocessing → Feature Engineering → Model Training → Evaluation

Methodology

Models

Logistic Regression, XGBoost, Random Forest, stacking ensemble

Training

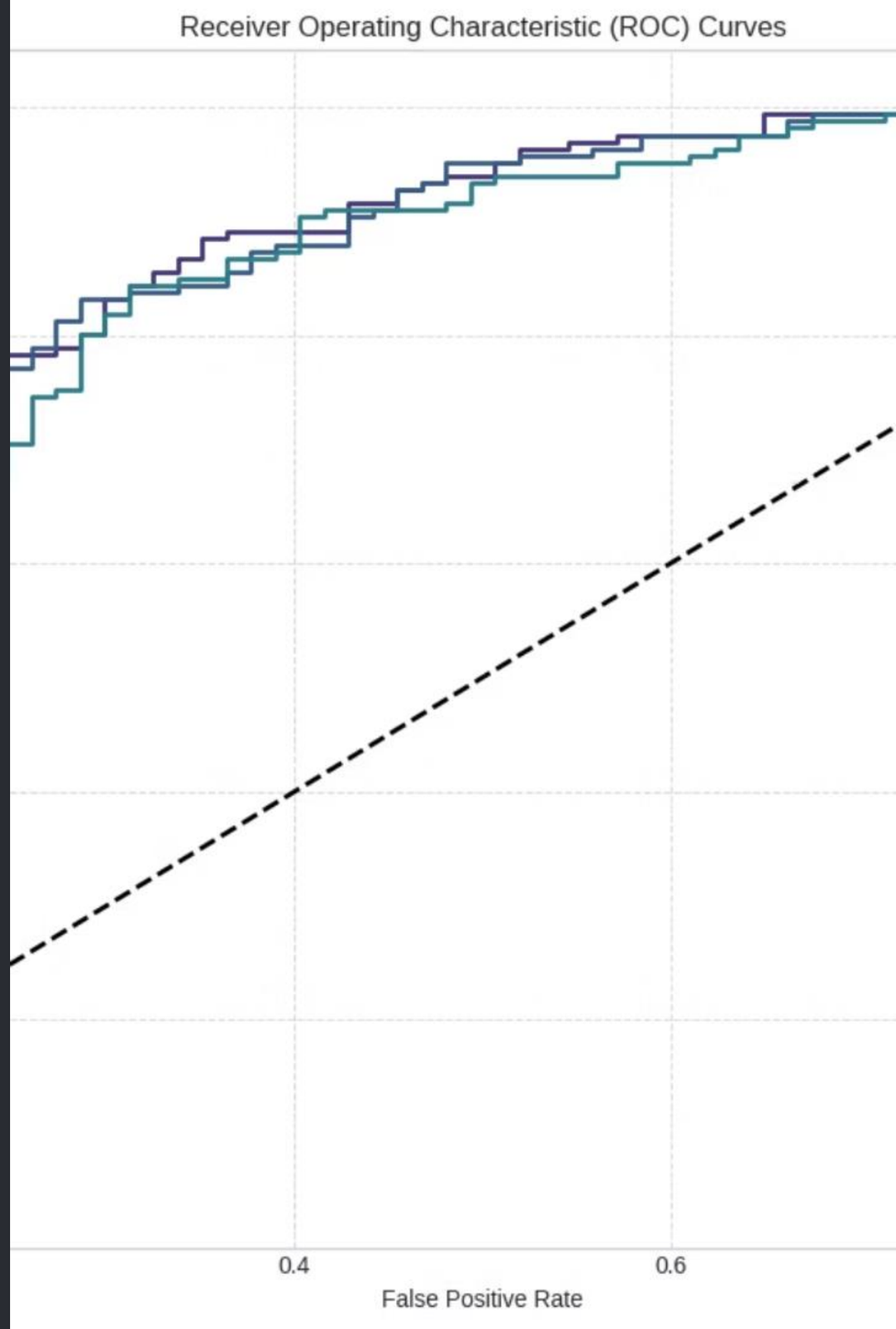
5-fold stratified CV, GridSearchCV

Metrics

ROC-AUC, recall, precision

Interpretability

SHAP values for feature importance



Model Performance

Model	ROC-AUC	Recall
Logistic Regression	0.8668	0.9639
Ensemble	0.8683	0.8977

Ensemble ROC-AUC

0.89 ± 0.02

Logistic Regression Recall

96.4%

Precision & Recall by Sex

- Males: 85% precision
- Females: 74% recall

Key Findings

DLPFC Connectivity

Top predictor (+0.21 SHAP)

SDQ Hyperactivity

Important predictor (+0.18 SHAP)

DMN

Critical for ADHD diagnosis

Sex Differences

- **Females: Amygdala**
- **Males: Cerebellar**

Limitations & Future Work

Future

- Multi-output ADHD+sex model.
- EEG diagnostics.
- Diverse datasets.

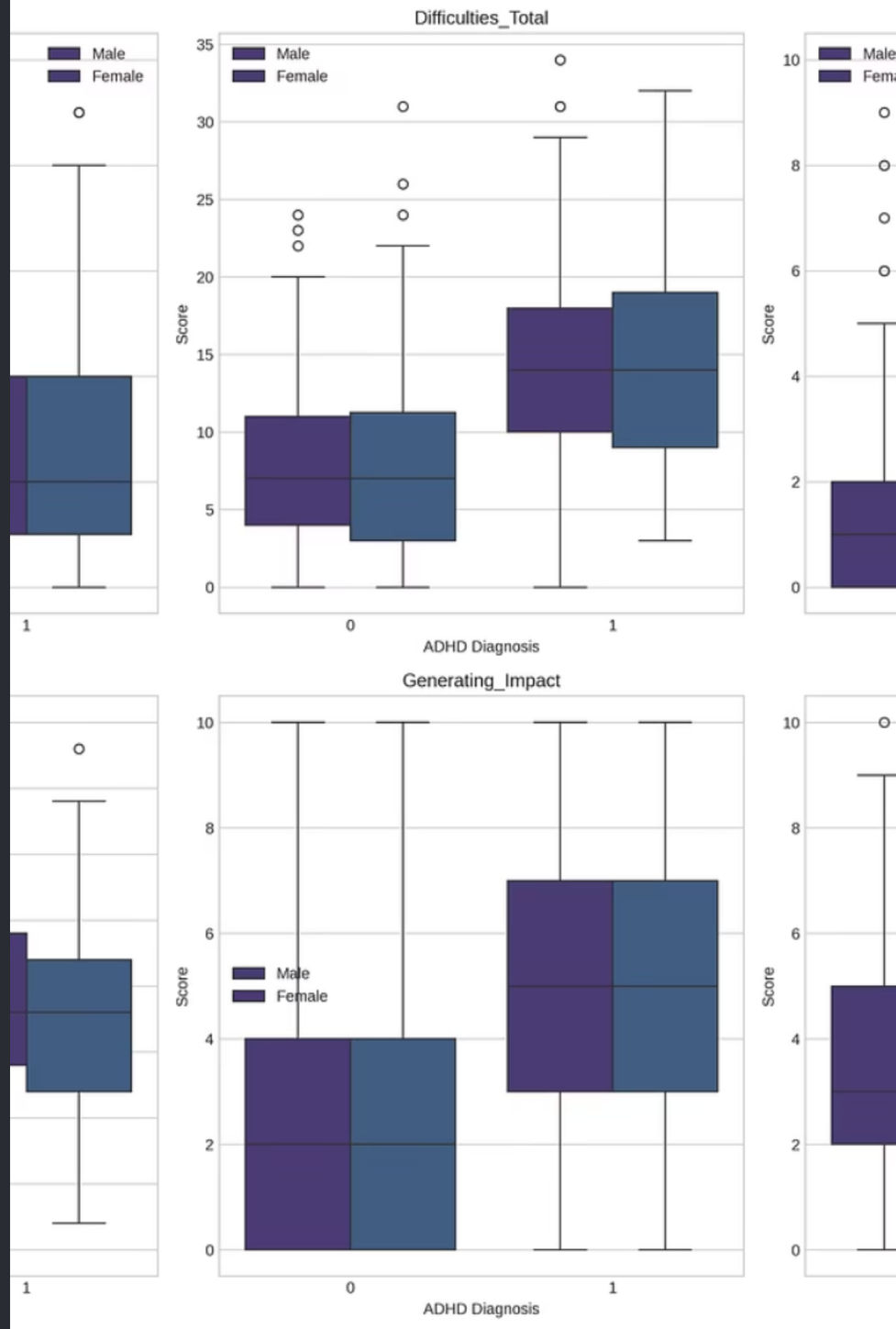
Limitations

- Small sample (~1,200).
- fMRI cost (~$500/scan).
- HBN data bias (severe cases).

Conclusion

- Identified DLPFC, amygdala as key ADHD biomarkers.
- Improved female diagnosis via sex-specific patterns.
- Open-source pipeline advances neuroscience-ML integration.

“This work contributes to equitable and interpretable ADHD diagnostics by combining domain-specific neuroscience with ML pipelines”



Thank you for your attention!

Questions welcome!

- **I sincerely thank | Dr. Babita Majhi, Assistant Professor |**
  for her invaluable guidance and support throughout this project.