Diabetes Prediction with Data Science

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Project Overview

Focus: Predicting Type 2 Diabetes using ML

Dataset: Pima Indian Diabetes Dataset

Methods: Data preprocessing, SMOTE, PCA, SHAP

Final Model: Gradient Boosting (GBM-DRU)

Accuracy: 87%

Aims and Objectives

Build interpretable, robust ML model

Handle class imbalance (SMOTE)

Feature selection with RFE and PCA

Explainability via SHAP, Permutation

Ethical and calibration evaluation

Data Preprocessing

- Outlier removal using IQR
- Handling missing/implausible values
- Feature scaling (StandardScaler)
- Balanced data using SMOTE

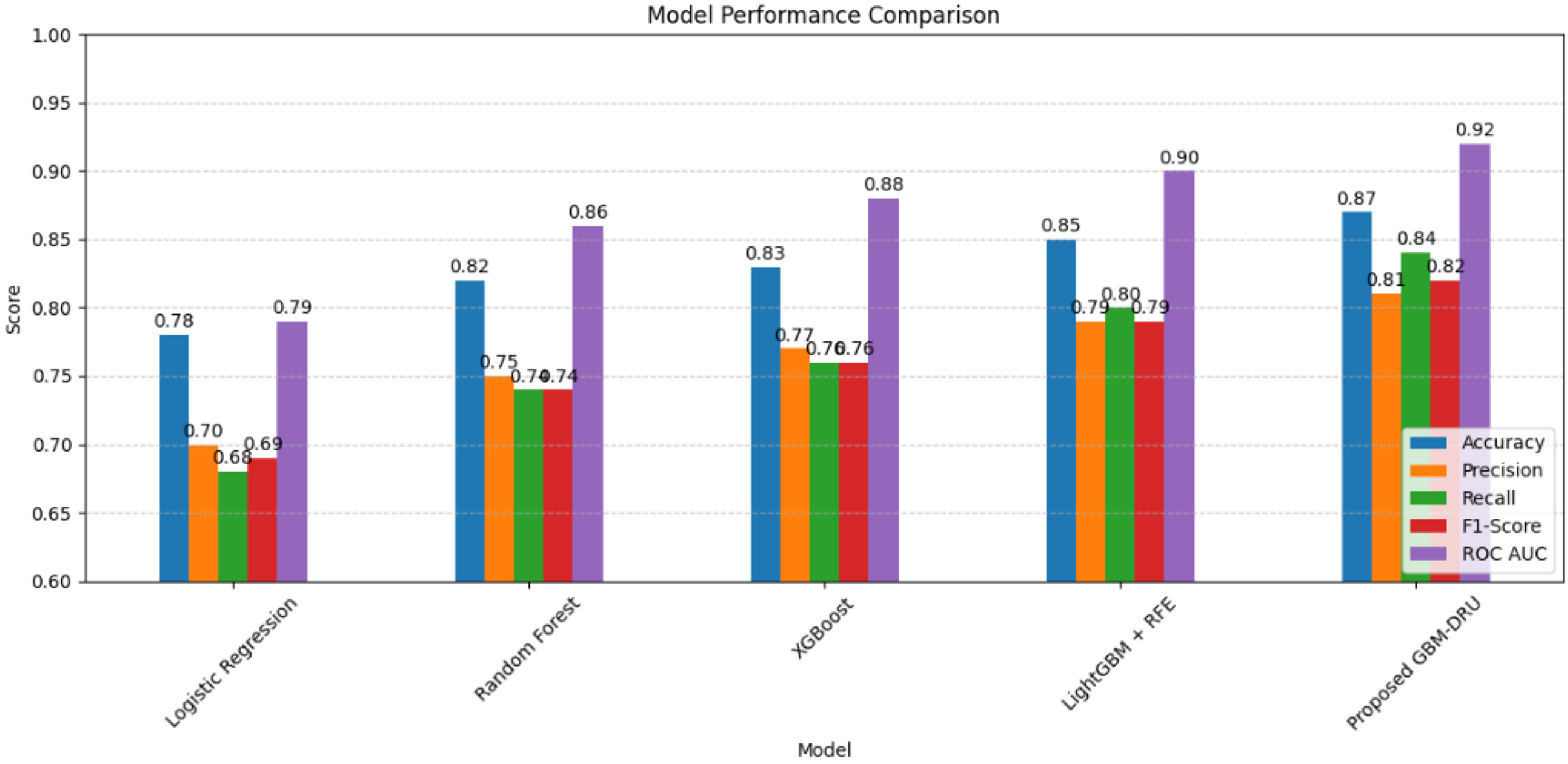
Model Development

Evaluated models: Logistic Regression, RF, XGBoost, LGBM

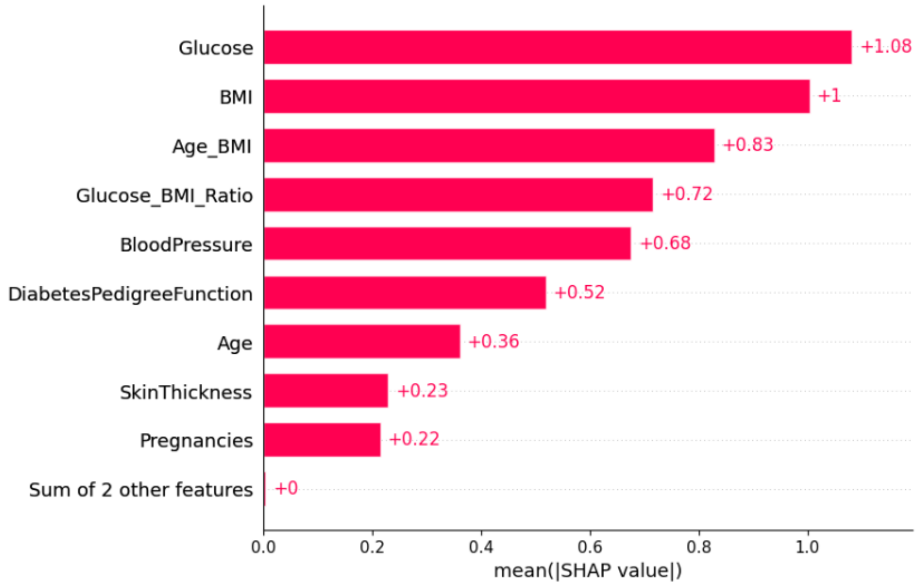
Final model: GBM-DRU = LGBM + PCA + SMOTE

Hyperparameter tuning with CV

Performance Metrics



Explainability



Tools: SHAP and Permutation Importance

Key predictors: Glucose, BMI, Age, Insulin

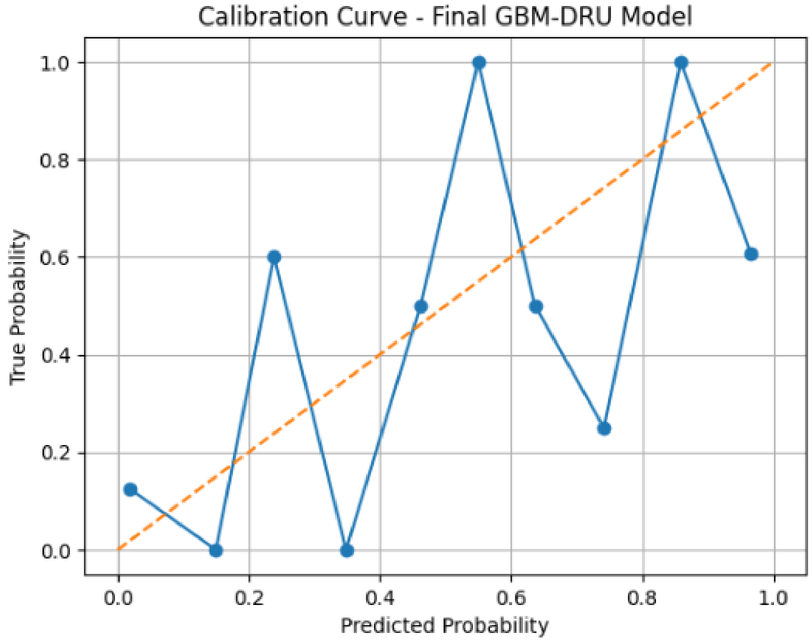
Supports clinical trust and transparency

Model Calibration

Calibration curves validate probability output

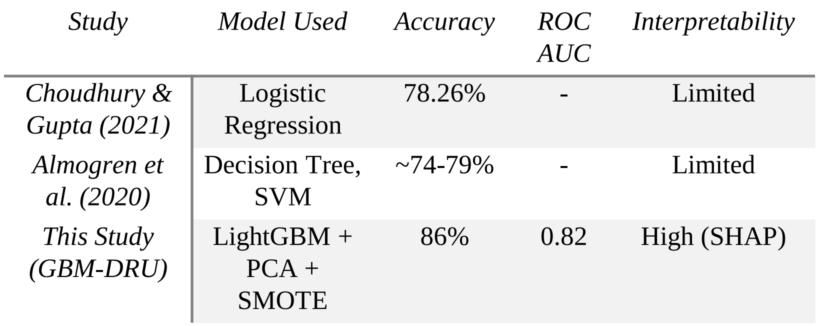
Slight underestimation at high confidence

Consider isotonic regression or Platt scaling



Comparison to Prior Research

- Choudhury & Gupta (2021): 78.26% (LogReg)
- GBM-DRU: 86% Accuracy
- Significant improvements in explainability and calibration



Study	*Model Used*	*Accuracy*	*ROC AUC*	*Interpretability*
Choudhury & Gupta (2021)	Logistic Regression	78.26%	-	Limited
Almogren et al. (2020)	Decision Tree, SVM	~74-79%	-	Limited
This Study (GBM-DRU)	LightGBM + PCA + SMOTE	86%	0.82	High (SHAP)

Conclusion

GBM-DRU outperforms traditional models

Methodologically rigorous and ethically sound

Ready for integration in clinical support systems

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Thank You!

Questions?