



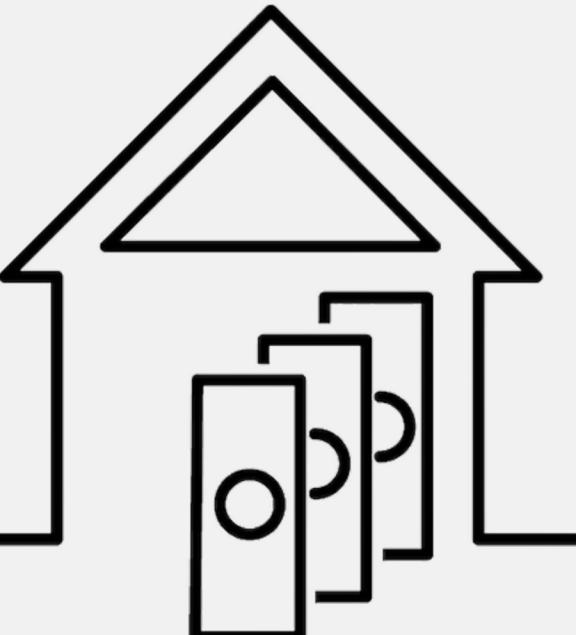
Smart Decisions, Faster Loans: Machine Learning for HELOC Approvals



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WHAT'S A HELOC?

A Home Equity Line of Credit is a secure way to access the equity built up in your home for large expenses or consolidating debt.



Why Automate HELOC Decisions?

01. Faster Processing & Cost Savings
02. Improved Accuracy & Reduced Bias
03. Enhanced Customer Experience

Prediction Task & Goals



01

Automate HELOC approvals
to improve efficiency



02

Ensure fairness &
transparency in lending
decisions



03

Reduce operational costs
and enhance customer
experience

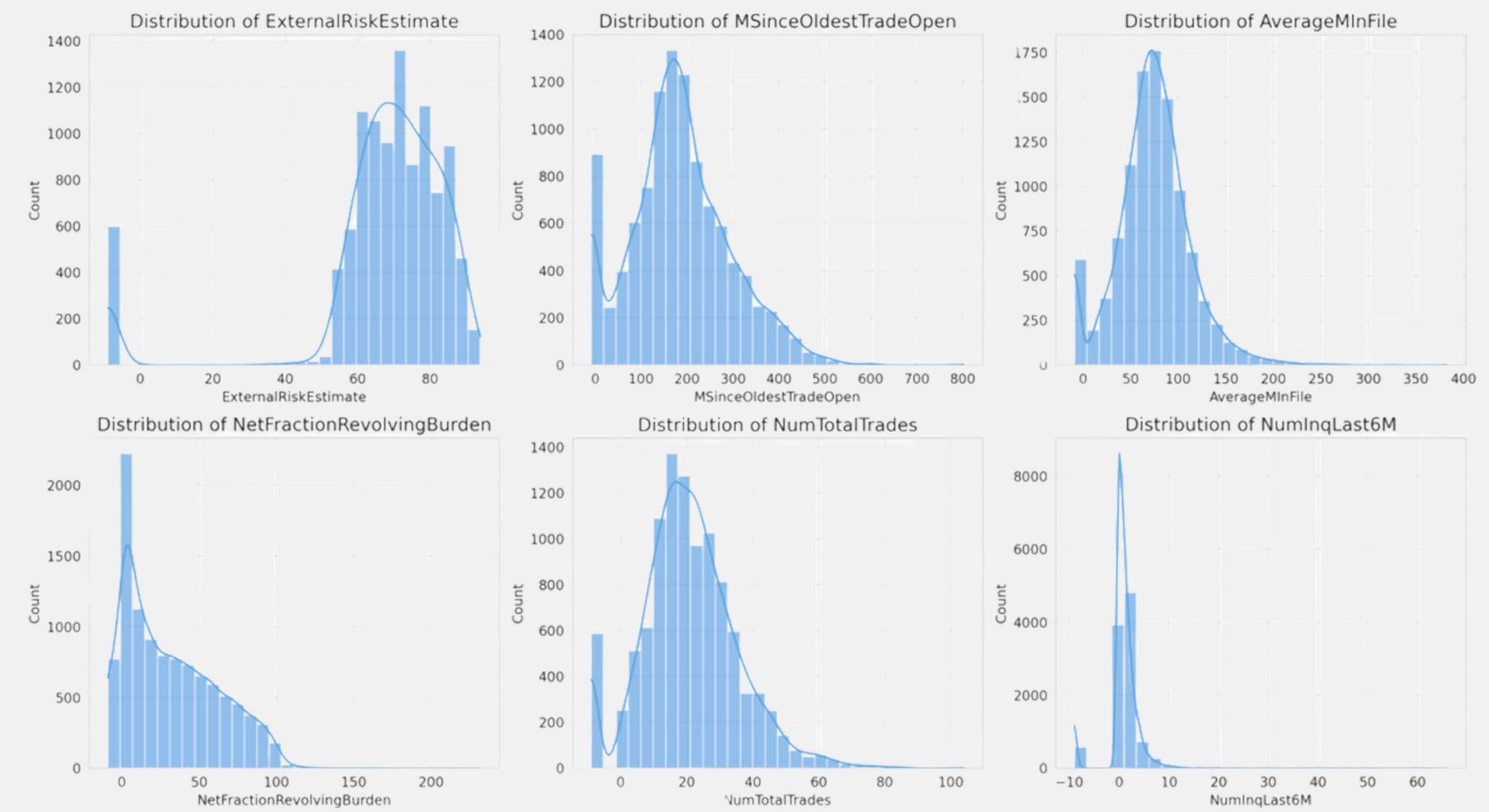


04

Provide explanations for
rejected applications and
offer improvement
suggestions

Missing Data (-7, -8 and -9 values)

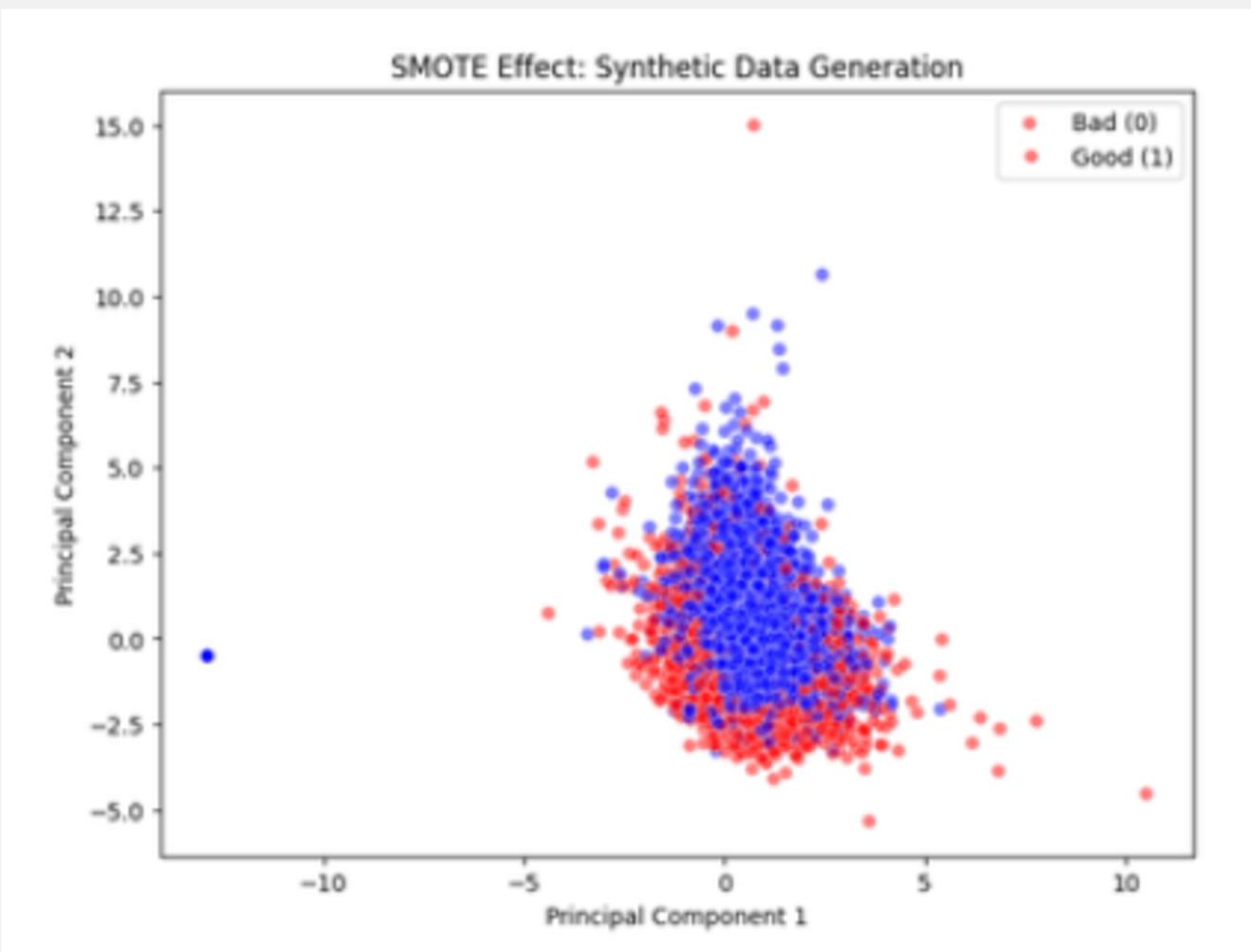
To address this, we applied mean imputation for -7 and -8 values based on the average within each RiskPerformance category, while rows containing -9 values were removed to maintain data integrity.



Occurrences of -7, -8, and -9 in dataset features.

Class Imbalance

To mitigate this, we applied Synthetic Minority Over-sampling Technique (SMOTE) to generate synthetic samples for the minority class, ensuring a more balanced dataset.



Class distribution before and after applying SMOTE.

Class Distribution Before Resampling

Bad	5127
Good	4133

Class Distribution After Resampling

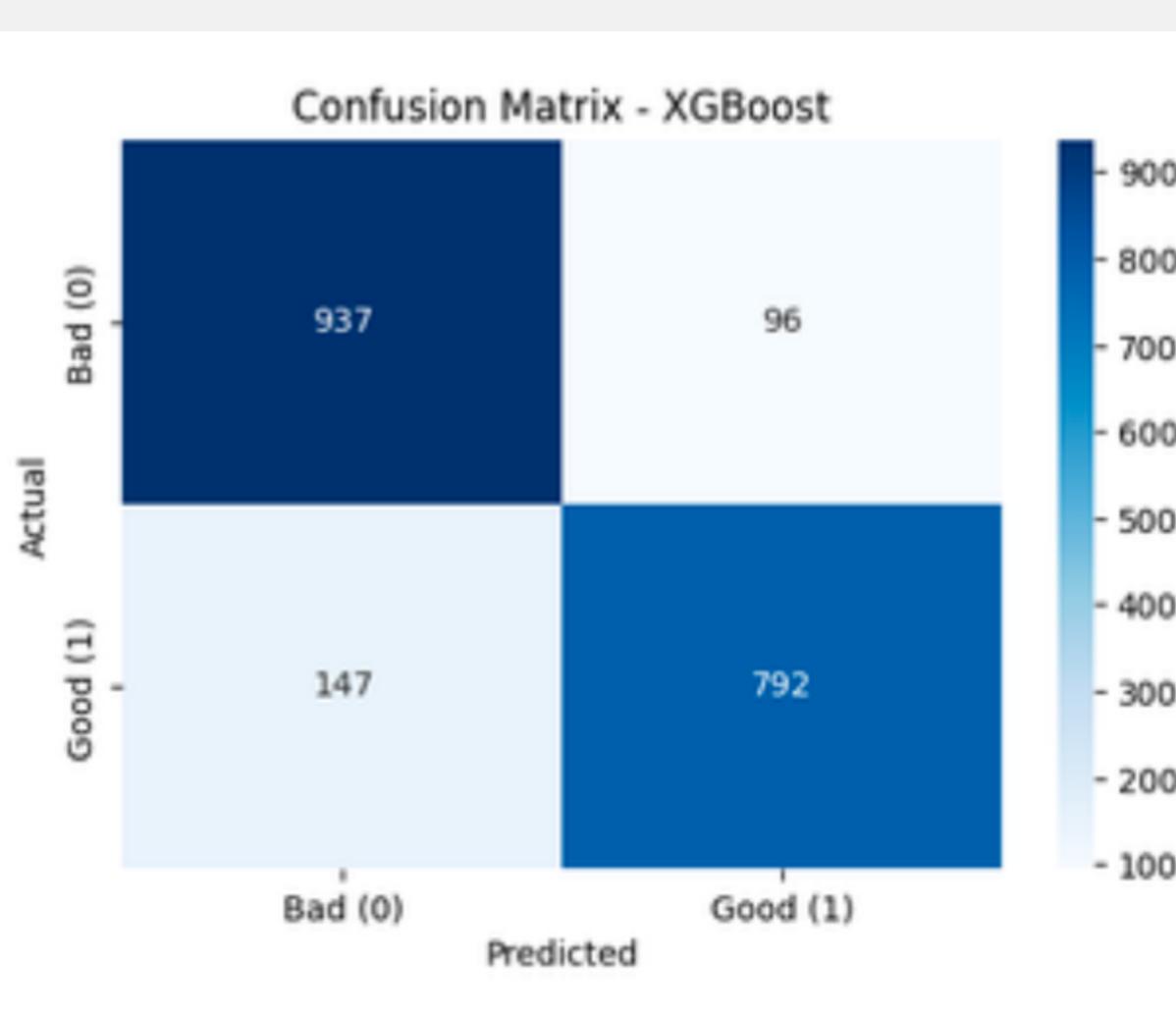
Bad	4094
Good	4094

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To develop an accurate HELOC approval model, we implemented a structured workflow including feature selection, model training, evaluation, and explainability analysis.....

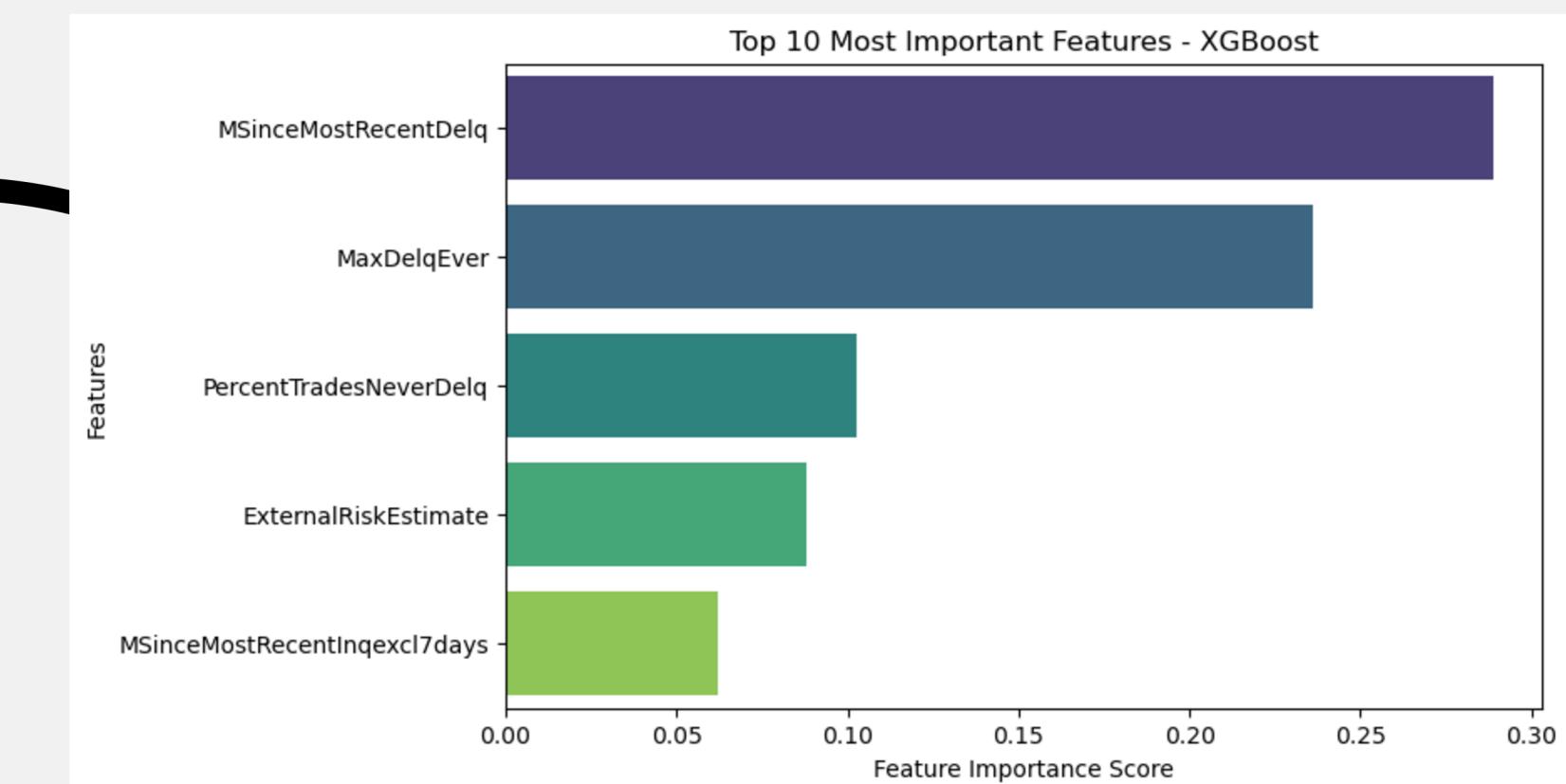
Model	Accuracy	Precision	Recall	F1-Score
XGBoost	0.880832	0.906467	0.854162	0.877532
Random Forest (Tuned)	0.876775	0.896355	0.838126	0.866263
Random Forest	0.868154	0.872667	0.846645	0.859459
Logistic Regression	0.715010	0.691760	0.724175	0.707596

XGBoost emerged as the best model, balancing 88.1% accuracy and 85.41% recall, making it ideal for minimizing misclassifications. The confusion matrix confirmed that XGBoost effectively distinguished between approved and denied applications, reducing false positives and negatives.

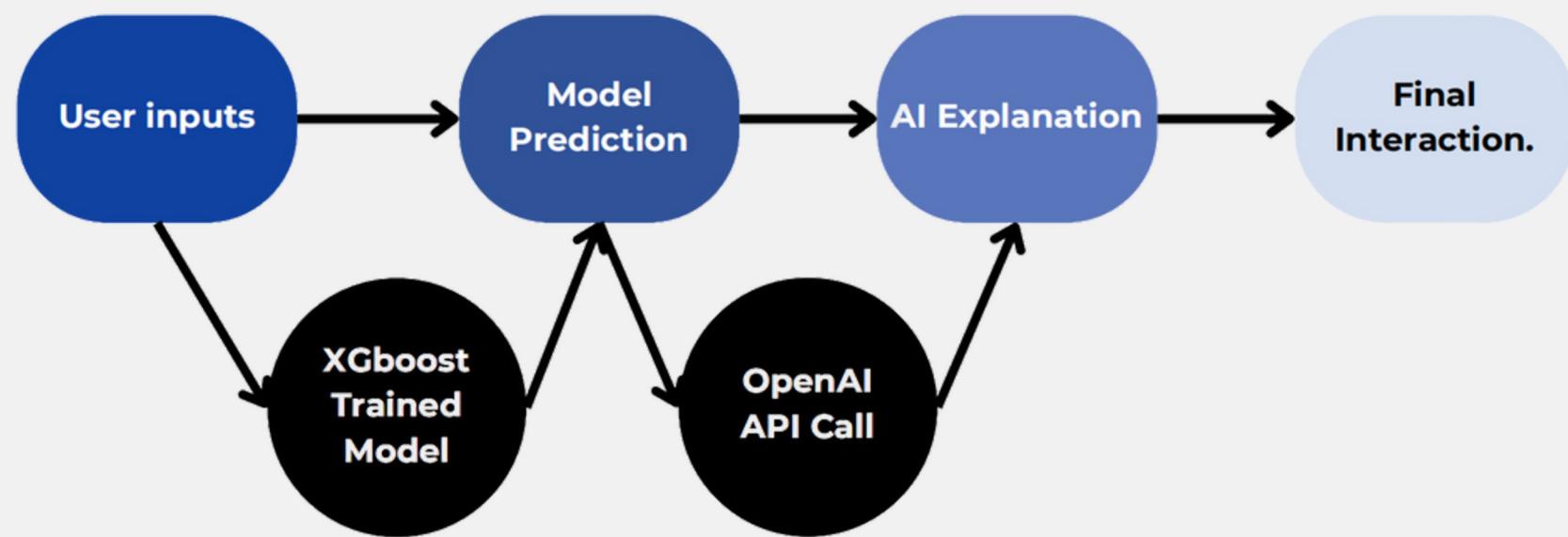


The confusion matrix confirmed that XGBoost effectively distinguished between approved and denied applications, reducing false positives and negatives. A comparative analysis showed that while Random Forest performed similarly, XGBoost was computationally efficient and more interpretable.

By using Lasso Regression, we streamlined our dataset and ensured that our machine learning models focused on the most meaningful financial indicators for predicting HELOC approvals.



Streamlit HELOC Decision Support System

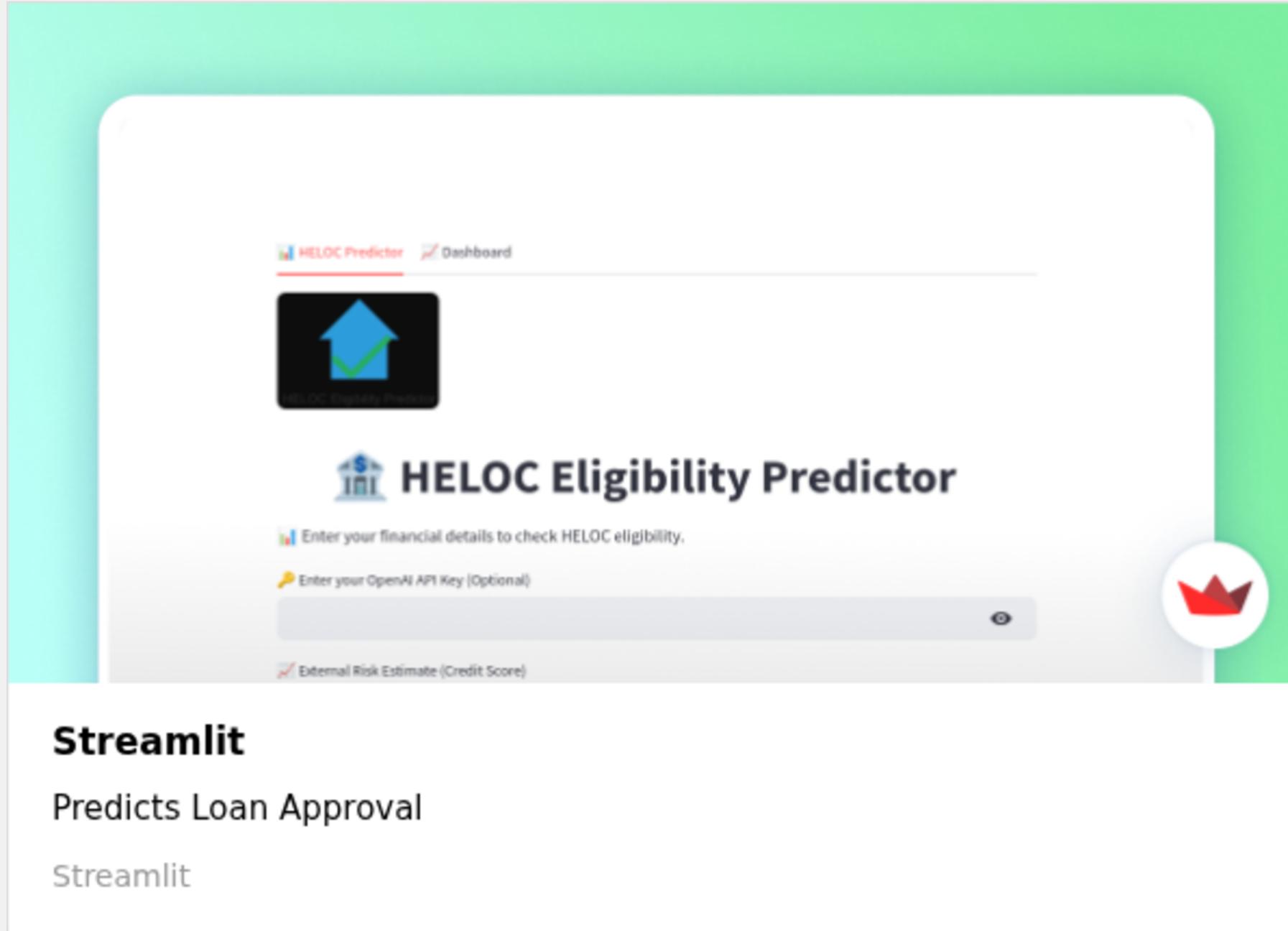


To bring our HELOC approval model to life, we developed an interactive web-based prototype which seamlessly integrates with our trained XGBoost model, enabling users to check their loan eligibility in real time.

HELOC Eligibility Portal

Welcome to Your Smart HELOC Assistant

- Interactive Data Input
- Real-Time Feedback
- AI Explanations & Suggestions
- Dashboard and AI chatbot



Streamlit

Predicts Loan Approval

Streamlit

HOW TO PREVENT PERFORMANCE DROP?

Monitor in real-time to detect accuracy issues.

- Implement real-time performance tracking to detect accuracy drops.
- Use A/B testing to compare model versions and ensure consistency.

Retrain with new data to adapt to changing trends.

- Regularly update the model with recent HELOC applications to adapt to market trends.
- Utilize online learning or periodic retraining to stay relevant.

IMPACT & COST SAVINGS

Reduction in Manual Processing Costs

- Automating HELOC approvals reduces reliance on manual reviews.
- Leads to significant labor cost savings for banks.

Lower Default Rates

- Machine learning helps identify high-risk applicants early.
- Reduces non-performing loans (NPLs) and default-related losses.

Increased Loan Approvals

- Ensures creditworthy applicants are not wrongly denied.
- Leads to higher revenue generation for financial institutions.

Operational Efficiency

- Faster loan processing improves customer experience.
- Enhances the bank's competitive edge in the market.

Any questions

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