

# **Predicting Customer Churn in Banking Sector**

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**Abstract:** *Banking customer churn represents a high financial burden, since it is more expensive to attract new customers than to retain current ones. Based on our previous work [1], this paper presents a fair, scalable, real-time churn prediction framework that mitigates data quality issues, lack of model interpretability, and adherence to regulatory policies. We combine cutting-edge data sources, including customer interaction sentiment analysis and temporal patterns of transactions, with state-of-the-art machine learning models, including LSTM networks and fairness-aware Random Forests. Our suggested methodology attains an AUC-ROC score of 0.97, a precision improvement of 20% compared with our earlier hybrid model (AUC=0.95), and guarantees fairness with demographic parity metrics. Implemented through a cloud-based FastAPI pipeline, the system allows banks to implement focused retention strategies that lower churn rates by approximately 25%. The contribution of this work lies in data science as it presents a workable, ethical, and scalable approach to customer retention in banking with possible extensions into other industries such as telecom and retail*

**Keywords:** Customer Churn, Banking Sector, Machine Learning, Real-Time Prediction, Fairness-Aware Models, Deep Learning

