Transaction Fraud Risk Modeling – Project Report

1. Introduction

This project focuses on developing a machine learning based system to detect fraudulent financial transactions. With the rapid growth of digital payments, fraud activities have increased significantly, making fraud detection a critical problem for banks and financial institutions. The objective of this project is to build a predictive model that can automatically identify suspicious transactions and help reduce financial losses.

2. Problem Statement

The main problem addressed in this project is to classify whether a given transaction is fraudulent or genuine. The dataset contains historical transaction records along with a target variable indicating fraud or non-fraud. This is treated as a binary classification problem where the goal is to accurately predict fraud transactions based on transaction patterns and features.

3. Models Used

Three different machine learning models were implemented and compared: 1. Logistic Regression – used as a baseline interpretable model. 2. Random Forest – an ensemble model that captures complex patterns. 3. Gradient Boosting – a powerful boosting algorithm that improves prediction accuracy. These models were trained on the processed dataset and tuned for optimal performance.

4. Results

The performance of all models was evaluated using metrics such as Accuracy, AUC, KS Statistic, and Gini coefficient. Gradient Boosting achieved the best predictive performance, followed by Random Forest. Logistic Regression provided interpretable results with reasonable accuracy. Bin-wise calibration showed good alignment between predicted and actual fraud rates. Population Stability Index (PSI) indicated stable model performance.

5. Conclusion

This project successfully demonstrates the application of machine learning techniques for transaction fraud detection. The models effectively identify high-risk transactions and can be used to support fraud prevention strategies in financial institutions. Future improvements may include real-time detection and deep learning approaches for enhanced performance.