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Anomaly Detection for Banking Fraud Prevention Using Advanced Machine Learning Techniques

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Abstract: *Over the past few years, because cashless transactions and digital banking are developing so quickly, the risk of financial fraud has risen significantly, which has left a high demand for the accuracy and real-time system of detecting anomalies. The effective machine learning-based banking fraud detection system suggested by this study should be able to recognize the presence of odd credit card transactions. To handle data noise and redundancy, as well as extreme class imbalance, the suggested technique would include sound data preprocessing, Random under sampling is used for class balance, while Principal Component Analysis (PCA) is employed to diminish dimensionality. Kaggle provides a sizable dataset for testing on credit card fraud detection (CCFD). Two very complicated models, Long Short-Term Memory (LSTM) and Extreme Gradient Boosting (XGBoost), are trained and evaluated using common performance metrics, including accuracy (acc), precision (pre), recall (rec), F1-score (F1), ROC, and AUC. The experiment shows that the XGBoost model performs marginally better with 99.8% acc, rec, F1, and an AUC of 0.999, whereas the recommended LSTM model obtains 99.7% acc, pre, rec, and F1. These findings prove the power, efficiency and great predictability of the proposed framework and suggest its suitability in actual-time application in the modern banking system to identify and thwart fraud in a successful way.*

Keywords*:* Fraud Detection, Machine Learning, Financial Security, Fraudulent Transactions, Anomaly Detection, Financial Transactions, Fraud Prevention

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