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Cost-Sensitive XGBoost Optimization for Credit Card Fraud Detection: A Strategic Decision

Communication Info

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Abstract

The escalating threat of financial fraud demands detection systems that work not just in theory, but in practice. Building on our previous analysis of unsupervised techniques—including VAEs and GANs—for anomaly discovery [1], we now optimize a powerful XGBoost framework that bridges the gap between statistical performance and real-world business costs. Confronting a critical fraud rate of just 0.17%, our method strategically engineers features and employs cost-sensitive learning, decisively outperforming traditional models with an AUPRC score of 0.8820. The true innovation, however, lies in our operational intelligence. Through a Marginal Cost Analysis, we define two actionable strategies: a precise threshold for automated blocking and a high-recall threshold for prioritized manual review. This work proves that the most powerful model is useless without the right business decision [2, 3]. We deliver a robust, scalable foundation for immediate deployment, ensuring technical excellence is matched by clear, impactful communication—a non-negotiable for global scientific contribution.

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