AI-Powered Credit Limit Decisions for Revolving Credit, A Reinforcement Learning Approach

Abstract

Advanzia Bank has leveraged predictive analytics and credit scorecards for risk assessment for over fifteen years. In revolving credit, optimizing credit limit assignment is crucial for maintaining profitability. While reinforcement learning (RL) has been applied across various domains, from deterministic environments to stochastic scenarios, its adoption in banking remains limited. This paper explores the use of RL techniques to develop an optimal credit card limit adjustment policy. The AI agent iteratively adjusts credit limits over time to maximize profitability. The state space is continuous, incorporating key features such as Probability of Default (PD), Revenue, Loss, Current Credit Limit, and Trend. The action space is discretized into predefined credit limit adjustments, constrained by existing loss thresholds. PD evolution over time is modelled using a survival model that estimates hazard rates at the customer level. Our findings demonstrate that RL algorithms - specifically Double DQN, Dueling DQN, and Actor-Critic DQN - offer a viable, data-driven alternative to traditional credit limit adjustment methods. We employ simulated data reflecting real-world German credit card usage to evaluate this framework and discuss the insights gained. Additionally, we compare the RL-based approach to conventional methods that frame credit limit assignment as a nonlinear constrained optimization problem, highlighting the potential advantages of AI-driven methodologies in this domain.

Authors & Affiliations

Konstantinos Bousoulas[1], Andrea Lunelli[1]
[1]Advanzia Bank S.A., Munsbach, Luxembourg