Low Collateral Blockchain Loans

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Introduction and Background

The emergence of Decentralized Finance (DeFi) marks a significant shift in the financial landscape, introducing a new paradigm where traditional financial services are replicated on blockchain technology. This innovation has led to the development of various financial instruments, including loans, without the need for centralized intermediaries. At the heart of DeFi's transformative impact is the concept of blockchain technology, which provides a secure, transparent, and decentralized framework for conducting financial transactions.

One of the critical aspects of DeFi is the provision of loans. Defi lending requires substantial collateral to mitigate risk, often making it inaccessible to a broader audience. This manuscript extends the research initiated by Tom Azoulay and Ori Rotenstreich in their article on Facilitating Blockchain Loans with Minimal Collateral, exemplifying continued exploration in this field.

In the realm of Decentralized Finance (DeFi), collateral plays a pivotal role. It serves as a security measure for lenders, mitigating the risk of default by borrowers. Traditionally, collateral in financial systems has been tangible assets like property or cash. However, in DeFi, collateral takes a unique form, often being cryptocurrency or other digital assets. This shift presents both opportunities and challenges.

Lending plays a crucial role in both traditional and decentralized finance (DeFi). It's a fundamental operation, with a significant portion of financial activities involving various forms of lending, such as loans and credit extensions. This widespread use of lending in conventional finance is increasingly mirrored in the DeFi sector, emphasizing its growing importance and potential to transform traditional financial systems. By adopting these lending practices, DeFi not only expands its scope but also demonstrates its capability to adapt and innovate within the broader financial landscape.

A smart contract in blockchain technology is a self-executing code that enforces predefined rules on a blockchain. It autonomously executes actions when certain conditions are met, without the need for intermediaries. Written in blockchain-specific programming languages, these contracts ensure tamper-proof and decentralized execution, making them ideal for trustless transactions and complex workflows in applications like DeFi and automated governance. Their immutable nature ensures reliability and transparency in executing contractual terms.

DeFi platforms encompass two major risks in the domain of lending, thereby creating a complex financial landscape. Firstly, the anonymity provided by blockchain technology, while perceived as advantageous for privacy, raises concerns regarding the potential for fraudulent or illicit uses. Secondly, the inherent volatility of digital currencies used on these platforms poses an additional challenge. Rapid price fluctuations can result in significant losses for borrowers and lenders alike, risking the financial stability of those involved. Thus, exploring solutions to mitigate these risks is imperative to ensure the credibility and long-term sustainability of lending on DeFi platforms.

The current solution to ensure the security of a loan in the DeFi space, particularly due to the high volatility of digital assets and the absence of centralized authorities, revolves around the use of overcollateralization. Borrowers are required to deposit collateral, usually in cryptocurrency, exceeding

the value of the loan. This method mitigates the risk of default and price fluctuations, as the collateral can be liquidated if the borrower fails to repay. Smart contracts automate this process, providing a trustless and transparent mechanism for loan management. This approach, while secure, does raise concerns about accessibility and capital efficiency, as it necessitates borrowers to possess substantial assets upfront.

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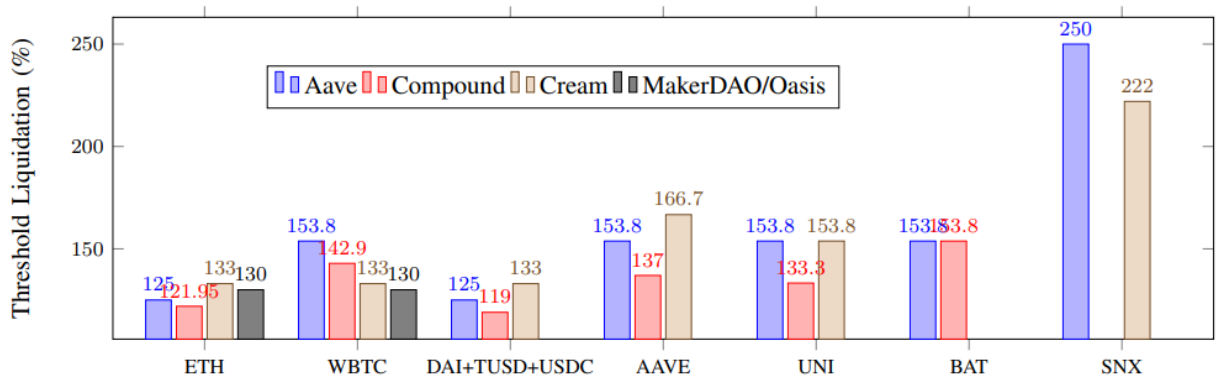

Figure 1. Threshold of liquidation based on the type of collateral for different lending platforms.

DeFi Lending Protocols

DeFi lending protocols are at the forefront of the DeFi ecosystem, offering innovative platforms for financial transactions. Among the most prominent are Aave and Compound, which have revolutionized the way lending and borrowing occur in the blockchain space. These platforms operate on the principle of smart contracts, automating the lending process and ensuring security and transparency.

Aave and Compound utilize mechanisms like overcollateralization, flash loans, and liquidity pools. Overcollateralization is a common practice in these platforms.

Liquidity pools in these protocols enable users to supply assets to a collective pool from which loans are issued, earning interest in return.

Innovative Approach to Low Collateral Loans

The 'Low Collateral Blockchain' project adopts a new approach in DeFi lending by dynamically adjusting collateral-to-loan ratios, considering not just the type of cryptocurrency but also the borrower's financial profile. This method diverges from traditional models that predominantly factor in only the type of digital currency when setting collateral requirements.

Central to this refined strategy is the categorization of borrowers into different classes based on their financial reliability, which is assessed using machine learning algorithms. These algorithms analyze a multitude of data points to predict the likelihood of default with greater accuracy than conventional methods. Borrowers are classified into categories such as 'good', 'average', or 'bad.

This tailored approach allows for a more nuanced and equitable lending model. By assigning lower collateral requirements to those deemed financially reliable ('good'), and higher requirements to higher-risk categories ('bad), the project aims to make lending more accessible and fairer. This strategy not only expands financial inclusion for a diverse range of participants but also maintains security for lenders, striking a balance between accessibility and risk management in the DeFi lending space.

Challenges in Adapting Traditional Credit Scoring for Blockchain

In initiating our project, our goal was to adapt an existing credit score algorithm suitable for the blockchain context. We explored various renowned algorithms, encountering challenges in selecting one that aligns with the unique environment of blockchain technology.

One prominent example is VantageScore, known for its comprehensive data collection across a user's various real-world accounts. However, its applicability is limited in the blockchain world due to the network's inherent anonymity. Blockchain's privacy features prevent access to the extensive personal and financial data that VantageScore relies on, making it incompatible with our needs.

This challenge is not unique to VantageScore; most traditional credit scoring and lending algorithms depend on extensive data collection about the user. In the blockchain domain, where user anonymity and data privacy are principal, these algorithms face a fundamental compatibility issue.

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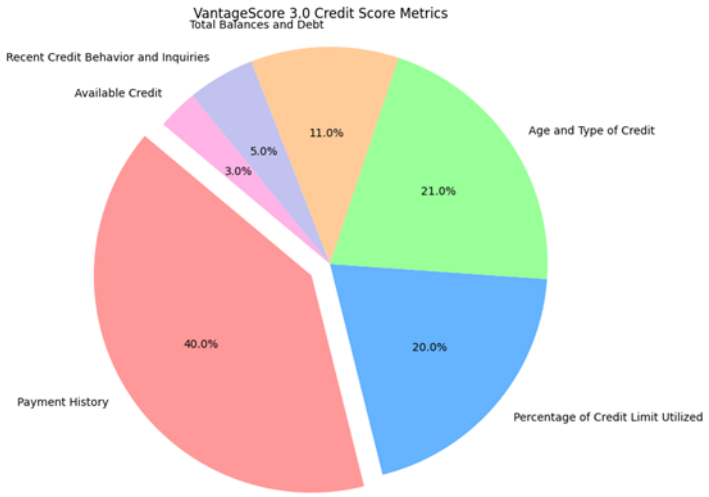


Challenges

In our project, we faced challenges due to the differences between blockchain networks and traditional banking systems and from false assumptions about our data used for training our machine learning model.

A key challenge was the lower-than-expected rate of loan defaults in the blockchain context, as users often increased their collateral to prevent default. This necessitated a shift in our AI model's focus from defaulting to identifying 'good' borrowers, characterized by their system longevity, stable collateral-to-debt ratios, and prompt loan repayments.

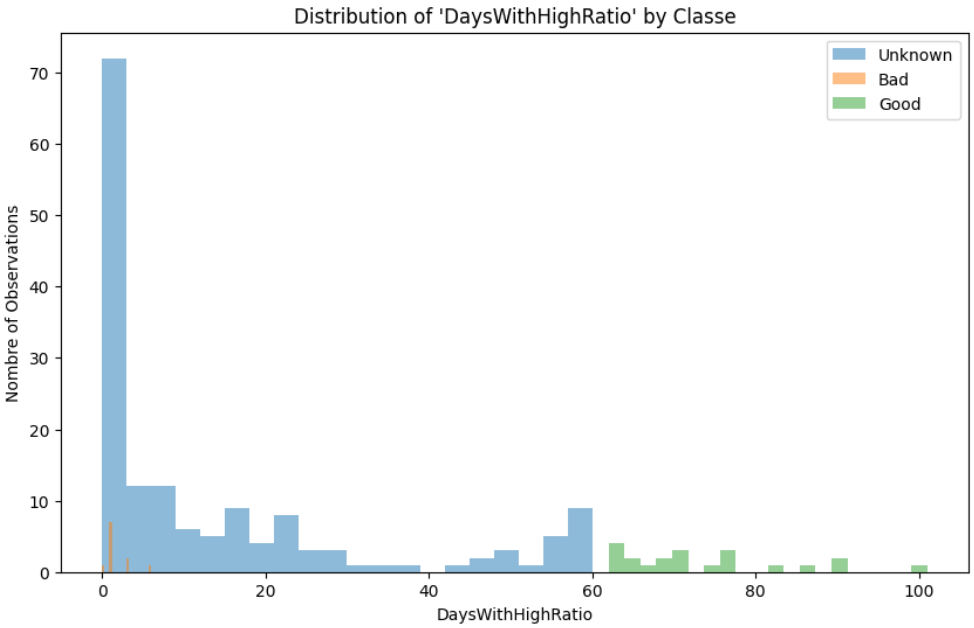
Regarding loan information, we concentrated solely on borrower data, disregarding non-borrower-related details. Also, debts paid by third parties were considered as repaid by the borrowers to keep our model's focus consistent and reflective of borrower behavior. This approach aided in developing a borrower-centric model, crucial for assessing and predicting financial reliability in the DeFi ecosystem.

Data Collection and Algorithm Development

The development of the machine learning model for the 'Low Collateral Blockchain' project involves data collection and algorithm design. Data is primarily sourced from Compound V3, encompassing a wide range of user behaviors and transactional data. This includes loan amounts, repayment history, collateral types, and market fluctuations.

The algorithm's foundation is built on analyzing these data points to discern patterns and indicators of financial reliability. Features considered in the model include payment consistency, collateral fluctuation response, and overall transaction history. The goal is to create a robust algorithm that can accurately assess the risk associated with individual borrowers, thereby enabling lower collateral requirements without compromising the security of the lending process.

In addition to the features provided, we have chosen to improve our analysis by incorporating additional parameters that we consider to be of significance. Among these, we have included metrics such as the number of days with a collateral-to-loan ratio surpassing a predefined threshold. We assert that these supplementary criteria play a pivotal role in evaluating the credibility and commitment of borrowers within the platform. Recognizing the importance of these factors, we aim to enhance the robustness of our assessment by considering nuanced dimensions that reflect the seriousness and reliability of borrowers participating in the lending ecosystem.



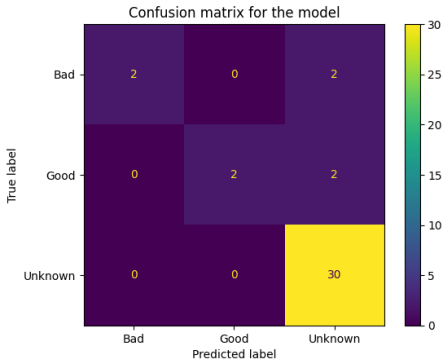
We have developed a function to categorize users as either good, bad, or average based on features such as the duration of account activity, repayment history, and collateral-to-loan ratio. These features were selected strategically, considering specific criteria. The account duration must be a minimum of 9 months, and the number of days with a collateral to debt ratio exceeding 2.2 must be at least 2 months. We find these criteria crucial in assessing whether a user is likely to fulfill their repayment obligations. Taking the example of a potentially malicious user, the function would label them as risky due to the newness of their account, thereby withholding trust. Similarly, a user who creates an account but refrains from engaging in transactions or depositing collateral would be categorized as risky since they fail to meet these essential thresholds. On the other hand, a long-standing user consistently depositing funds and meeting the repayment criteria would be classified as a good user.

Model Testing and Evaluation

Our project embarked on an extensive exploration of various machine learning models, aiming to identify the most effective algorithm for our credit scoring system within the blockchain framework. This phase was characterized by comprehensive model experimentation and hyperparameter tuning to refine performance and enhance accuracy.

A focal point of our evaluation was the K-Nearest Neighbors (KNN) algorithm, where we conducted an in-depth analysis by adjusting the 'k' value. This parameter tuning was crucial in determining the model's sensitivity to the proximity of data points, directly impacting its accuracy. Our findings indicated a delicate balance, as the model's performance peaked at a specific 'k' value before declining, suggesting an optimal range for this parameter in our context.

Additionally, we employed a confusion matrix to evaluate the precision and recall of our models. This tool proved invaluable in visualizing the performance of each algorithm, particularly in classifying users across the 'Good', 'Bad', and 'Unknown' categories.



The Random Forest algorithm emerged as a standout performer, showing high accuracy in the classification of 'Unknown' users and moderate accuracy for 'Good' and 'Bad' users. Through fine-tuning of its hyperparameters, we achieved an optimal configuration that surpassed the performance of other models tested. This strictness in classification meant that when Random Forest labeled a user as 'Good' or 'Bad', it did so with a high level of confidence, based on clear patterns in the data.

In conclusion, the Random Forest algorithm was identified as the superior model in our testing and evaluation phase. Its robustness and adaptability make it an ideal candidate for our blockchain-based credit scoring system, capable of handling the nuances and complexities of DeFi lending.

Limitations and Future Work

In assessing the limitations and potential avenues for future research in our project, we acknowledge that our current approach, while robust, can be further refined to address certain challenges and expand its capabilities.

Firstly, our model's categorization of users into discrete groups has shown promising results; however, we recognize that a more granular differentiation (not only 3 classes) could potentially refine the risk assessment. Future work might explore the impact of a continuum-based model versus discrete categorization, which could offer a more nuanced understanding of borrower risk profiles.

Secondly, the treatment of new users in our system presents an opportunity for improvement. Presently, the lack of historical data may lead to conservative risk assessments. A more sophisticated approach could involve provisional categorization with dynamic adjustment based on early behavior patterns, rather than defaulting to a lower trust level. This would not only provide a more equitable starting point for new users but also enhance the system's adaptability to real-world user behavior.

In future work, we can enhance the credit scoring model by implementing a 'time-windowing' approach. This method involves structuring new user registrations at regular intervals, such as monthly. This strategy aims not only to ensure a continuous influx of new users but also to reduce the proportion of low-quality users, a phenomenon observed in dynamic environments like streaming platforms.

Consequently, we anticipate regularly regenerating our user base, thereby maintaining the robustness and relevance of our scoring system.

Finally, ongoing changes in the regulatory landscape and the evolution of blockchain technology itself will necessitate continuous updates to our model.

In conclusion, while our project has laid a solid foundation for blockchain-based credit scoring, the field is ripe with opportunities for further research and development. The pursuit of these opportunities will no doubt contribute to the advancement of DeFi lending practices.

Conclusion

This study has delved into the transformative 'Low Collateral Blockchain' project, a pioneering effort in the DeFi lending space aimed at mitigating the challenges posed by high collateral requirements. The innovative use of machine learning algorithms stands at the core of this project, enabling a more nuanced assessment of borrower reliability. This approach has the potential to significantly lower collateral demands, thereby enhancing financial accessibility and efficiency within the DeFi framework.

A key discovery of this research is the feasibility of reducing collateral requirements without compromising the security and integrity of the lending process. This breakthrough is instrumental in democratizing access to finance, potentially fostering a more inclusive financial ecosystem. The project's impact on DeFi lending is profound, offering a brief look into a future where financial services are more equitable and accessible to a broader audience.

As the DeFi landscape continues to evolve, the insights and methodologies developed through this project are expected to fuel ongoing innovation and expansion within the domain of decentralized financial services. The research underscores the vital role of technological advancements in shaping the future of finance. However, it is important to recognize the project's limitations and the need for continual refinement and adaptation to address the complexities of borrower behavior and the dynamic nature of the DeFi market.

In conclusion, while the 'Low Collateral Blockchain' project lays a foundation for blockchain-based credit scoring, the field is ripe with opportunities for further research and development. Pursuing these opportunities will undoubtedly contribute to the progressive evolution of DeFi lending practices, reinforcing the project's vision of a more accessible and efficient financial landscape.

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