

Poster: DyCREM: Dynamic Credit Risk Management Using Edge-based Blockchain

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Abstract—Banks play an important role in the financial market, and their profit mainly comes from loan service. Traditional risk management approaches, as the key part in the loan services, still have several issues including low data credibility, unreliable checking and alert delay. We propose a novel dynamic credit risk management system which leverages edge-based blockchain technology to improve the performance and provide a fair loan environment. Besides, we discuss the potential challenges that the system may face, such as data standards, security on edge and scalability.

Keywords—Blockchain, Edge Computing, Dynamic Risk Management

I. INTRODUCTION

Banks play an important role in the financial market by adding more value to the money and maintaining the health of the ecosystem. As an intermediary agent, they help savers keep the money and allocate funds to the credit borrowers. Loan contributes a lot to the banks' profit [1], and risk management is the key to the success. Credit risk refers to the potential for loss due to a party in an agreement not meeting its contractual financial obligation in a timely manner [2]. It is the aspect that banks care most when allocating funds to the borrowers. Traditional credit risk management normally includes two stages: In pre-assessing stage, the borrower is evaluated based on the historical records and the value of the mortgage items. After analyzing the credit level, the bank will recommend corresponding loan services. In post-management stage, banks need to track borrowers' status periodically to make sure everything is in order as planned. If abnormal behavior happens, banks should get an alert and handle the potential loss immediately. However, there are several problems with the traditional procedure:

- *Data credibility*: The results of the pre-assessing stage mainly depend on the collected data. the borrower may fake the records to appear as a good candidate, the situation is even worse in joint fraud.
- *Unreliable periodical checking*: In post-management stage, bank employees physically go to the borrower's location to check the current situations and fill forms. Due to the human factors, the results are not always reliable.

- *Delay in rule-based alert*: Usually the alerts are triggered based on the pre-defined thresholds, when the alerts are triggered, the loss already exists and it will continue growing.

With the developing of the new technologies, we think blockchain and edge computing can work together to improve the performance of today's credit risk management system.

Blockchain was first mentioned in [3], due to its outstanding performance in multi-party cooperation [4], [5], the technology can significantly change the credit risk management methodology. First, blockchain makes the data more trustable. The block generate mechanism guarantees that it is not worthy to pay such a huge price to put fake information on the chain. Second, the data on the chain is traceable and immutable, all the history information can be retrieved, and borrowers cannot manipulate the data to apply for a loan. However, the performance of blockchain is highly influenced by the consensus mechanism. In the bitcoin system, the performance is seven transactions per second(TPS) [6]. In order to maintain an efficient system, we should not only carefully choose a consensus mechanism, but also just record important data and conclusive results instead of all the detailed information.

Edge computing [7] which provides computation capabilities near the data source can help with the data issue and improve the efficiency. After collecting all the data which may include text files like financial statement and real-time video of mortgage items, edge node can pre-process them and output conclusive statements and crucial events. This will reduce the on chain data size. Besides, with the collected real-time data and the prediction alert model got from banks, edge node can evaluate the current status of the borrower and give feedback immediately to minimize the potential loss.

II. SYSTEM DESIGN

We propose a dynamic credit risk management system DyCREM (as Figure 1 shows), which mainly contains three components: Edge Node, Blockchain System and Private Cloud, to minimize the loss and provide a fair loan environment. Blockchain can support history-based static evaluation method, and we prefer permissioned blockchain since it matches the

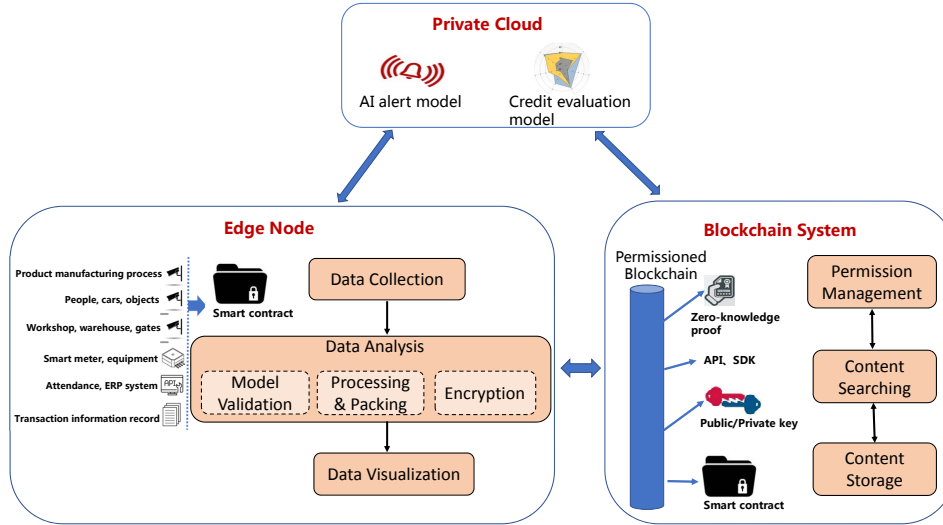


Fig. 1. Outline of the DyCREM system.

real physical scenario very well. Edge computing is helpful for dynamic real-time data monitoring and analysis.

Edge node is composed of three modules: a) The Data Collection Module handles all the raw data. It is compatible with several data transmission protocols, such as Wi-Fi, Bluetooth and Zigbee. Besides, it hides the complexity of different data structure and provides a group of unified APIs for upper layer to get the organized data. b) The Data Analysis Module is responsible for model validation (given the alert model and credit evaluation model, the edge node takes the real-time data as the input, calculates the results and sends the feedback to the banks), processing and packing (based on the raw data, the edge node detects the key events and generates conclusive statements that should be put on the chain) and encryption (cooperated with the blockchain system, the data is encrypted based on the borrower's key). c) The Data Visualization Module presents the raw data in a friendly way to the user.

In DyCREM, the blockchain is used to support related technologies, such as smart contract and encryption key distribution. From a functionality perspective, the blockchain system has three modules: Permission Management is responsible for managing the member of the current network and their privileges. Content Searching provides an efficient searching service for banks to get borrowers' history information that is stored on the chain. Content Storage is responsible for putting the processed data on the chain, which includes the consensus mechanism and the management of the underlying storage.

Private cloud refers to banks' own cloud and it is used to build different evaluation models. Based on the recent data from the blockchain, a bank can train its own credit evaluation models and alert models according to its business services.

III. CHALLENGES

In the DyCREM system, we leverage blockchain to enhance data credibility and edge computing to minimize potential loss.

However, to build an efficient system, there are several aspects that we should take into the consideration.

- *On chain data standards:* 1) For different types of business, what's the key data should be recorded? Borrowers may come from different industry (e.g. Amazon VS Ford), their workload and working environment could be totally different. 2) For different loan services, their requirements are not the same and the data they concerned is also different. How can we automatically match different data standards and extract the effective information to evaluate the borrower?
- *Data security on edge node:* Blockchain technology makes sure the data on the chain is immutable and enhances the data credibility, but how can we trust that the original data is correct? Before the data is put on the chain, an edge node is responsible for its storage and processing. Hence, the data security on the edge node is very important. There should be some approaches to prevent fake information from the data source.
- *Scalability:* With more and more banks joining the system, the permission management will become complex. Besides, the business services of the banks may overlap with each other and new services are continuously developed, which add difficulties to the content searching module to fetch effective data in a limited time. Moreover, as the member increases, the performance of consensus mechanism and the maintenance of the platform also become challenging.

IV. SUMMARY

We propose a dynamic credit risk management system DyCREM which takes the advantage of blockchain and edge computing to improve the performance as well as provide a fair loan environment. Besides, we discuss the three potential challenges. This work is still in the initial stage, we will further evaluate the system in the future.

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