

Bank Risk Control based on FPGA and Machine Learning

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ARTICLE INFO

Keywords:

Bank risk
Machine learning
FPGA
Control system

ABSTRACT

With the continuous increase of machine learning in business applications, it is being considered that many of the solutions are implemented. Due to the impact of the global financial crisis, the bank has achieved a more pronounced risk management, and risk, discovered measured, there was a continued interest in the reporting and management methods. In academia and industry, a lot of research, development banks and risk management, focuses on the current new challenges of. That what has been proposed is an analysis and evaluation of machine learning techniques that have been studied in the risk management of the bank, this is a completely on-site and risk management issues, and to determine. This will explore the potential areas for further research. The application, review risk management and machine learning centers, such credit risk, market risk, risk of learning machine of banking, such as liquidity risk has been shown to operational risk have been studied, It does not seem to be comparable to the level in the current industry. Many of the fields, in the ruins of machine learning, and risk management in the banking, you can benefit greatly from the study of methods that can be applied to solve a specific problem.

1. Introduction

The overall money related crisis, peril, and threat the chiefs of the Bank have gotten more expressed; it was found assessed, there was a continued with eagerness for the reporting and the board procedures [1]. In both insightful world and industry, it is a lot of investigation pulling in the thought bank and peril the board and the headway of the current troubles. Pair, the impact of enormous business application programming on AI is broadening, and there are various plans, and it has been executed has been more searched for. The limit of the Bank's threat in 2025 ought to basically [2]. Today is special. Stretching out of increase and rules, customer wants to progress, and the sort of progress of threat are needed to propel risk the chief's change. New things, organizations, and risk the board advancement has been engaged by applying the endlessly creating development and advanced logical methodologies [3]. Computer based intelligence, recognized as one of the techniques for fantastic centrality to risk organization, perceives the staggering and nonlinear models in gigantic educational records. It can be perceived the improvement of a more definite peril model. The judicious power of these models, thusly growing the time perceptive power, can create at every additional information [4]. To the extent that AI is underscored as a promoter of rising business, it will ponder the risk the board concerning the budgetary business; by then, to perceive the feasible zones for extra investigation. The inspiration driving this study

report, evaluation, and assessment, to affirm that surveys the risk the chiefs AI procedures that have been applied to the Bank, the field, and the issue of peril the board has been inside and out investigated [5].

Instead of using the current composition to choose the Bank's specific peril, this article provides a request reliant on the new development and study of the Bank's yearly report [6]. Examination of the current composition, the AI advancement, such threat the board has been amassed in the field, for instance, banks, have been surveyed. In the assessment, AI, to review the risk district that has been made on the sort of threat. Specifically, they oversee risk [7]. The assessment in like manner uses both AI estimations for a particular space and the general solicitation and a short time later recognized.

2. Related work

The board mission for the Bank has extended the pay for the owners who are taking a risk with a development in cost. Bank, advance cost peril, market risk, credit danger, various threats looked by crooked sheet things danger, specific peril and operational peril, cash risk, country and sovereign peril, liquidity danger, liquidity peril and liquidation peril [8]. The best approach to effectively manage these risks is the Bank's introduction. Similarly, thinking about these perils, banks' part in the cash related structure, they are needy upon the energy of managerial authorities. Managerial authorities, there is a huge load of threat of the

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<https://doi.org/10.1016/j.micpro.2020.103472>

Received 26 October 2020; Received in revised form 6 November 2020; Accepted 12 November 2020

Available online 15 November 2020

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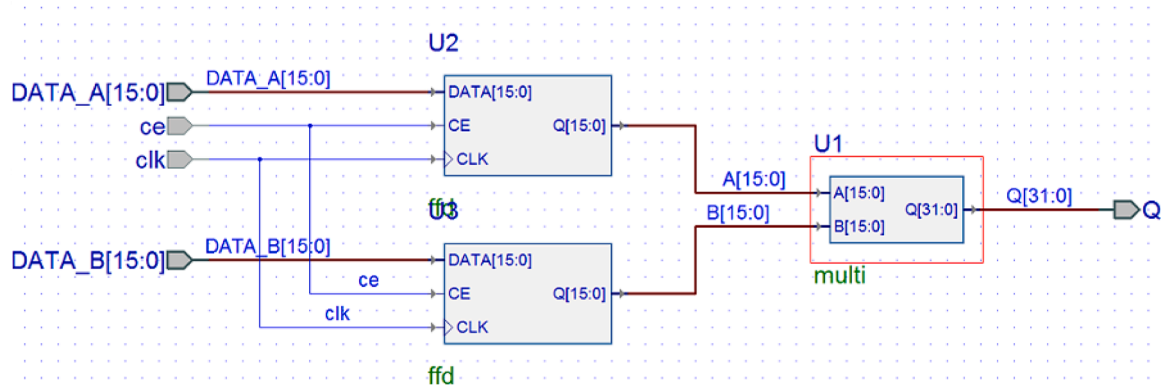


Fig. 1. shows the Key parameters of FPGA, ML and their role in the Bank Risk process.

prerequisite for banks to hold capital. It is delivered made by another bank. Confirmation of the Basel standard of capital essentials was made in 1998; it is the new development, starting now and into the foreseeable future, has been made [9]. Capital is required for such a critical peril. Credit risk reliably is; banks have become the most serious threat to face, under no gigantic conditions, and requires the most resources [10]. Marmot basin, dominantly from the Bank of the trade movement, present, operational threat, is the risk of incident in view of inside structure dissatisfaction or outside capacities. Despite registering managerial capital, most tremendous banks, not to the Bank of the model, rely upon authoritative necessities to discover the budgetary capital. Banks' essential risk, credit, market and operational threat, liquidity, various kinds of perils, including business and reputation danger, is. Bank adequately these perils, watching, the board and assessment, it is risk the chiefs [11].

2.1. FPGA Architecture

Shortening reduced NRE costs and time to market products:

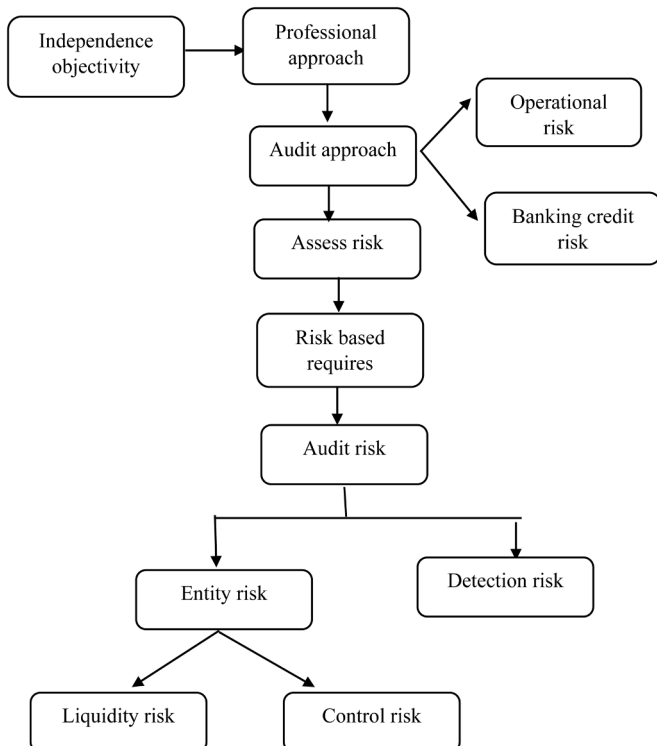


Fig. 2. shows, risk control flow diagram

Flexibility: ASIC for FPGA to implement any digital circuit, or Compared to a fully custom-designed circuit, it offers two main advantages to you. Cutting, off-the-shelf FPGA devices, programmed to implement a simple written Hardware Description Language (HDL) or recent high-level programming language, as well as in a digital circuit, and can be within a few hours [12]. NRE to create a Mongolia, cost, On the other hand, production ASIC design week and a few million, or to take each iteration of a few months, to run the design through the most advanced node manufacturing plant of the country. However, the programming of the FPGA, performance, and large silicon area more as compared to the ASIC, higher dynamic power consumption, has been at the expense of low-cost. Reference circuit used in this study was due to the relatively small hard cutoff limited use, less than 12% in the range of the size of the 16544 look-up table on the 68 strategic II Devices (LUT) 0 to 22 DSP module it represents 23% of the available LUT and DSP resources [13].

2.2. Machine Learning

Computer based intelligence, programming designing, planning portrays lying at the combination of bits of knowledge. It is particularly has been pushed as a contraption that can be applied to an arrangement of issues. It depicts the data fields and takes basic exercises. Progress of the web lists and self-impelled vehicles uses an AI contraption is hoisting to be applied to the cash related territory [14]. Improvement of various progressions, including an enormous proportion of data establishment, different sets around, to examine, to the responsibility of the cash related region to have the choice to have my things, a structure that has not been the sorting out of the market and client account data it has come [15]. Furthermore, AI accepts a capacity in the US Securities and Exchange Commission (SEC) in a specific peril assessment measure [16]. This can be applied to the oversight of perspectives and central risk the executives; it is relative AI advancement, including the threat to the association, to recognize blackmail (internal or outside), pertinent to the peril evaluation such that enables it to be, appraisal by it can similarly be used as a guide the underwriter or counterparty for the Bank. In assessment cash, from a total exploratory data assessment to the presentation/portrayal of the proliferation results has astonishing AI potential, it will in general be distinctively used [17].

3. Methods and Materials

Model, two complementary phases, including the FPGA phase and ML phase. Specifically, FPGA approximates the overall trend in risk, finding ways ineffective factors that are the most influential. Anne ML can be used to check the trend of the FPGA to be able to find the factors that most influence. As also indicated below, rather than the ML method, it also makes it possible to determine the probability of liquidity risk occur if all of the indicators were measured.

Table 1
Simulation Parameters

Parameters	Value
Simulation Tool	python
Data size	100mb
Method	ML
Hardware	FPGA

3.1. Key Parameters of FPGA, ML and their role in the Bank Risk process

Results generated by both of the FPGA phase and ML phase is based on the study of technology. The initial point, starting from (random amount in FPGA and ML- prior distribution), the first network is generated. Until close to the primary data pattern or distribution, the network is trained in the data set.

In Fig. 1, FPGA defines the input variables' function and then tries to find the best of the weights (coefficient) of the variable. This feature is, when I was sufficiently "learning" to approach the target value, is ready to predict the trends of liquidity risk.

3.2. Risk Control on Bank Side

To determine the Bank's specific risk, as an alternative to confirm the complete annual Bank of the report, use the existing literature. According to the review, the classification will draw different risk types of banks using conventional methods and tools; trying to manage as part of their business. Bank of the annual report of the top 10, was studied to determine the risk area. It is, these banks will be exclusively reporting. The review includes identifying a particular tool, method, or component of the risk management framework used. From each area of the Bank, the list of banks, representatives from the business sector that these banks operated, investment banking, securities trading, consumer and retail banking, a wide range of companies Bank it is included to obtain more comprehensive coverage. Their risk is discussed, it has been proposed in which the method of including the different, the most significant risk, credit risk management, including market risk management, liquidity risk, and operational risk, a large part is the same.

In Fig. 2 shows, Assess Risk Officer, what was the one to understand what happened, focus on the reason, insight and intelligence, nearly, such as the analysis of such an accident, you have the opportunity to obtain a more retrospective. Now, more and more, they are gearing up to use the tools that are permitted to help predict the outlook of detection risk.

4. Results and Discussion

Machine learning technology, also in the classification, in both the prediction accuracy, than the traditional statistical methods, have been proven to work well. The support vector machine is seen as a large-scale test to prove the method of machine learning. Many empirical studies are based on the observation data. Selection mechanism, whether or not due to the sample design or sampling unit's operation, will give results in a non-random sample. The researchers of the data set used in their sources' study are varied, from some of the received data by a commercial bank or financial services provider (for example, Moody's). Some researchers used publicly available data provided by the academic Database.

Table 1 shows using the Machine learning method FPGA in our proposed method.

4.1. Credit Risk

The back of the global financial crisis and the focus inevitably increase in regulatory, credit risk assessment process, an increase in interest from the academic and business was seen. General methods credit

risk assessment analyzes the relationship between customers' characteristics for delinquent users, and their potential failure is to apply the classification techniques on historical customer data, including the evaluation.

Fig. 3 shows, Support Vector Machine (SVM) is a teacher machine learning algorithm. This has been used for widely classification problem; it is a relatively new credit score. In this algorithm, the area of each data item appears to be an-dimensional space, is small. For points, each feature (the N feature) the coordinates of a specific value. Classification by separating the two hyperplanes was a boundary found. Support is the use of a vector machine, or there are several different forms to be used (arrears of <90 days) within a narrow range. Design a credit risk assessment and credit scoring model based on the SVM credit scoring model (> 90 days past due). The latter is the more traditional way. As a broader definition improves prediction accuracy, using the established model has proven to be more accurate.

4.2. Market Risk

Risk also can be measured by the unexpected result is known as the standard deviation of volatility. After the Value of Risk (VAR) has been calculated, neither self-confidence is there to capture the combined effect of exposure to potential volatility and financial risk. A given level, it has the most severe loss beyond the target horizon. Prediction of the financial markets' volatility, risk management, and asset pricing is essential in other areas.

Fig. 4 shows that stochastic differential equations machine learning methods to solve can be applied to formulate an anticipatable VAR model for central risk measurement of the market's regime change. This is, you can solve some of the complex issues brought about in part by the regulatory environment.

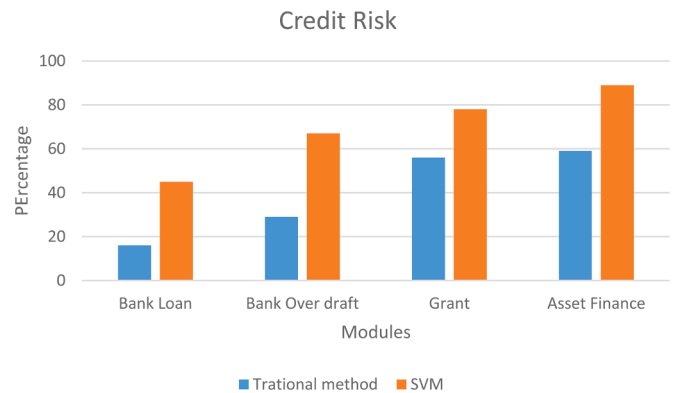


Fig. 3. shows the credit risk chart diagram.

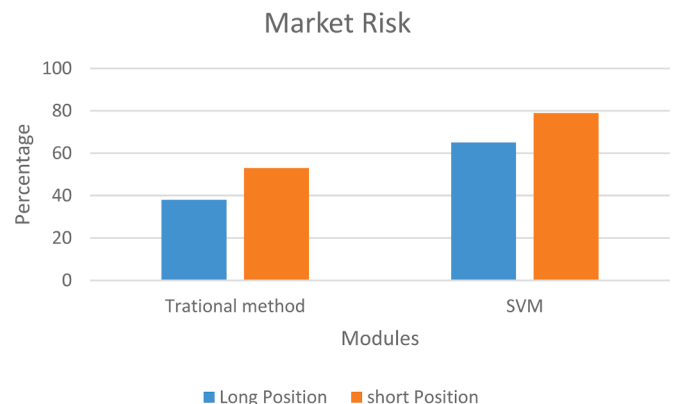


Fig. 4. shows the market risk.

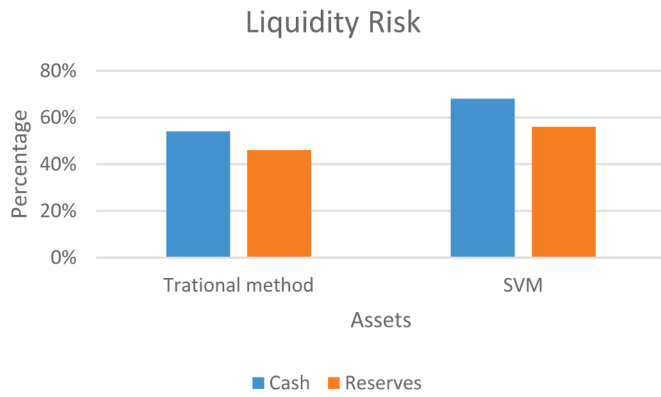


Fig. 5. shows the liquidity risk.

Table 2
shows the operational risk.

	traditional method	SVM
Rating	3	5
Descriptive	Good	High credit Quality

4.3. Liquidity Risk

Some of the problems of liquidity risk can be solved by using machine learning. Measurement of liquidity risk, the main factors, including the investigation and analysis of interconnection between sources, can be achieved by using machine learning.

Fig. 5 shows that the probability that the liquidity risk event occurs can be application ML estimates. The ML implementation can distinguish risk as measured by the most critical liquidity risk factors by estimating the function approximation.

4.4. Operational Risk

Machine learning, to enable the detection or reduction of risk, which is an application of prevention of risk, is also in the business area. In terms of operational risk and the network of security, machine learning and focuses mainly focus on the detection of fraud detection and suspicious transactions.

Table 2 describes the proposed report of the prototype to enable the detection of suspicious transactions. They have also been included in the current implementation of the detection of suspicious transactions that are monitoring the automation of the process in a variety of banks that can be examined through software solutions is worth noting. In money laundering, criminals overlaid their legal transactions to conceal the trustworthy source of funds and pass the money through various transactions. Funds can usually be derived from the crime, or illegal activities continue to be used for other illegal activities, including terrorist activities. To detect financial crime, in recent years, extensive research using conventional statistical techniques.

5. Conclusion

It recognized the future of machine learning in the banking and financial industry. To improve its capabilities in risk management, we are expected to adopt a machine learning technique. Despite being criticized as a black-box operation, the amount of data exploratory analysis, to provide a classification and much valuable, without being

limited by the assumption of distribution is limited to the predictive analysis's ability, technology was analyzed by machine learning, and it is significant. It offers the potential to revolutionize the field of risk management. Machine learning, identified as one of the techniques of great significance to the risk management in large data sets by identifying intricate nonlinear patterns, can be achieved to build a more accurate risk model. Banks, since appears to have matured the company's risk management capabilities, how it would be useful to study machine learning can it applied to the aggregation of risk and strengthen the risk reporting capabilities. But can be done in the areas of risk, it is, for example, such monitoring and activities business areas such as monitoring of behavior, these areas can benefit is to become more benefits from the application. ML is an ideal candidate for the application of loan risk assessment. Robust fault-tolerance FPGA knowledge information, because it uses a distributed storage topology, does not output the damage of individual units is wrong is generated.

Declaration of Competing Interest

The authors declared that they have no conflicts of interest to this work. We declare that we do not have any commercial or associative interest that represents a conflict of interest in connection with the work submitted.

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