ISSN: 2093-5374 / E-ISSN: 2093-5382

Financial Model Construction and Identification of Abnormal Activities in Mobile Networks for e-commerce Platform Using Machine Learning Algorithm

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Received: April 17, 2024; Revised: June 26, 2024; Accepted: August 05, 2024; Published: September 30, 2024

Abstract

The advancement of informatization has significantly affected many sectors due to e-commerce, rendering the existing Financial Model (FM) inadequate for e-commerce customers. Artificial Intelligence (AI) substantially enhances the financial accounting capabilities and resource integration of systems using mobile networks. The insufficient FM of e-commerce tools and issues such as the administration of funds have significantly obstructed the advancement of standardized financial procedures, as the FM structure impacts managers' statistical evaluation of financial information. This research examines the financial hazards, management issues, and underlying causes of these issues inside e-commerce systems, subsequently employing AI to assess the FM operations of these websites in Peru. This research uses a Machine Learning (ML) approach to examine the clustering centers of FM information as well as the privacy aspect of the FM. This study ultimately presents ways for optimizing and constructing FMs to enhance data security and capital

Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications (JoWUA), volume: 15, number: 3 (September), pp. 222-235. DOI: *10.58346/JOWUA.2024.I3.015*

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administration in e-commerce financing, hence fostering the continued growth of e-commerce systems using mobile networks. The experimental findings indicate that the FM's classification value and security aspect for e-commerce systems progressively enhance under the ML. The average classification value is 1.23, whereas the average risk factor is around 1.41. AI and ML improve financial accounting requirements and the long-term growth of e-commerce systems in Peru.

Keywords: E-Commerce, Financial Model, Machine Learning, Mobile Networks.

1 Introduction

E-commerce is an advanced business model derived from conventional overseas trade, enhanced through digital networks and e-commerce mechanisms (Escursell et al., 2021). E-commerce represents a sophisticated application mode since the e-commerce platform facilitates the conversion of money, foreign exchange, and transactions. E-commerce has precipitated substantial transformations in the global economy and trading. It surmounts regional obstacles in international commerce and facilitates the seamless advancement of foreign trading. The e-commerce system aligns more closely with contemporary attributes as it amalgamates the initial e-commerce operations to create a novel trading system (Alqaryouti & Shaalan, 2022). In the past few years, e-commerce has experienced fast development and has a growing stake in import and export commerce. Examining e-commerce's financial challenges will be essential to advancing the platform in Peru.

Machine Learning (ML) systems exhibit greater efficiency and enhanced accuracy than conventional rule-based or manual classification models (Deniz et al., 2022). They can autonomously adjust to diverse categories of anomalous Financial Model (FM) without necessitating rules or the manual creation of classifications. ML technology necessitates substantial data and computation capabilities; hence, evaluating computational expenses and data storage challenges is imperative while managing extensive datasets. Gather atypical FM phrases and do searches on e-commerce sites (Yemunarane et al., 2024). It can do preliminary screening of outcomes from searches to exclude many non-anomalous FM. Manually categorize the remaining results to distinguish between regular FM items and aberrant financial goods (Zhao et al., 2021). It maintains an equilibrium between normal and aberrant FM to prevent ML algorithms from disproportionately emphasizing specific financial items in Peru. Construct a model with an ML architecture and conduct training. Concurrently validate the model to ascertain its capability to detect anomalous securities appropriately (Wu et al., 2021). The ongoing investigation of ML and computer vision technologies offers a novel approach to FM information processing. The growing intricacy of FM information has heightened the need for its interpretation. As the Internet emerges as a pivotal force in social growth, it permeates many facets of human existence, giving rise to diverse e-commerce enterprises and online corporations predicated on commercial websites (Zhu et al., 2021).

The Internet is marked by an extensive volume of knowledge and data, and an increase in users enhances the value of this data (Cao et al., 2022). Mobile banking is fundamentally a subset of finance, primarily tasked with adequately managing risks using mobile networks in Peru. The Internet has facilitated several technologies and database mining techniques, enhancing conventional banking services. The dangers associated with FM are unpredictable, and an adequate regulatory framework is absent. Implementing a regulatory framework to assess the risks associated with FM is imperative.

This article concludes, by a comparative examination of the trials, that the e-commerce FM significantly enhances the information safety of money transactions and the precision of FM data reporting (Rath et al., 2021). An ML banking platform can protect financial data against foreign entities

in Peru. The e-commerce FM mitigates financial sourcing and operational dangers for firms, decreasing managerial choices' error rate in mobile networks. The FM precisely tracks the flow of banking transaction data, aiding portal administrators in capital management.

2 Background

A multitude of scholars have examined e-commerce. Singh et al. utilized the e-commerce web-based database to construct an index reflecting e-commerce's affluence and risk profile. This demonstrates that the sector has progressively adopted more cost-effective and efficient advertising methods and pathways, substantially enhancing the risk profile (Singh & Kaur, 2021). Zerbini et al. suggested a study framework for e-commerce's intention to buy grounded in the involvement concept and dedication participation principle. They evaluated the model via structural equation modeling using correlation (Zerbini et al., 2022). Cui et al., developed a novel structure to analyze user transferring intentions in the e-commerce mobile networks. They examined the interconnections between user commitment, transferring costs, and transfer purpose, offering recommendations for firms within the e-commerce mobile networks (Cui et al., 2020). Baah et al., focused on supply chain decision-making, elucidating the influence of typical behavioral traits of platform individuals on the decision-making processes within e-commerce systems (Baah et al., 2022). This study examined structure revenue administration and the competitive and cooperative dynamics among platform suppliers and online merchants (Abdo et al., 2023). Jaisri et al., supplied a collection of e-commerce sales information from rapid-fashion retailers to elucidate the influence of fulfillment alternatives on e-commerce revenue and sales (Jaisri & Balaji, 2024). He et al., delineated the principal themes of e-commerce and proposed a structure elucidating the key elements influencing e-commerce (He & Liu, 2024). He & Liu, recognized deficiencies in the research and directed studies to rectify these deficiencies. They utilized the bilateral matching approach inside the e-commerce context, assessing the happiness of stakeholders, and subsequently validated the framework's practicality and efficacy using computational simulation. The research has delineated the function of e-commerce but has not addressed financial issues.

E-commerce handling finances streamlines the platform's electronic fund transactions. Researchers developed an economic warning system for the e-commerce system, utilizing ML to assess and forecast the financial hazards of publicly listed companies (Podvalny et al., 2021; Oleksandr et al., 2024). Asaithambi et al., examined the improvement of the vendor credit mechanism within the e-commerce system (Asaithambi et al., 2024). A multi-objective collaborative decision framework for picking suppliers and demand distribution was constructed using mobile networks' choice matrix, distinction matrix, and cloud-based modeling assessment technique. The objective was to examine the correlation between financial actions by the joint decision-making paradigm. Hassan et al., developed an enhanced e-commerce payment model utilizing the secure online purchase method (Hassan et al., 2020). They evaluated this enhanced payment model's effectiveness and safety ratings against the conventional face payment technique through simulated tests. Gupta et al., analyzed the present e-commerce landscape, identified primary issues, and highlighted areas for enhancement through the planned exclusive FM, offering many essential recommendations (Gupta et al., 2023). The research above elucidates the FM of e-commerce, yet shortcomings in financial risk mitigation persist.

Despite the e-commerce platform's substantial online sales, it encounters significant budgeting issues (Sunarto et al., 2023). The site's managerial models have been restructured into the e-commerce corporate structure, facilitating company advertising and altering the conventional business approach, thereby significantly enhancing sales via the collaborative efforts of e-commerce websites and external

platforms (Engert et al., 2022). The cost-effectiveness of the structure based on the e-commerce concept has been consistently improved in mobile networks. They have concurrently articulated apprehensions over FM, which should substantially influence the platform's administration and expansion. The unified accounting procedures of the e-commerce system would facilitate its robust and long-term growth.

3 Proposed ML-based Financial Model

1) Construction of FM

This research employs a Deep Neural Network (DNN) model and a Computer-Aided Design (CAD) model for recognizing financial risks in e-commerce commodity operations, focusing on detecting abnormal FM in e-commerce. Increasing the number of layers in DNN often allows for extracting more complex characteristics in mobile networks. This doesn't mean the system can enhance its learning merely by adding additional layers. Unlike the Conventional Neural Network (CNN) architecture, the remaining network employs a residual block framework, enabling a DNN while maintaining lesser complexities. This facilitates the optimization of the depth residual networks. Detecting financial danger in e-commerce trading of commodities utilizes a deep trust system integrated with a Multi-Layer Perceptron (MLP), resulting in a model comprising an MLP component and a Deep Trust Network (DTN) component in mobile networks. The DTN component processes input signals to extract features, enabling the acquisition of higher-level abstraction characteristics. The MLP component executes categorization tasks inside the identification system. Equations (1-3) show the model normalization.

$$\hat{p}_{xy} = \frac{p_{xy} - \hat{p}_y}{s_y} \tag{1}$$

$$p_y = \frac{1}{N}\sum_{x=0}^{N-1} p_{xy} \tag{2}$$

$$S_y = \frac{1}{N-1}\sum_{x=0}^{N-1}\left(p_{xy} - p_y\right)^2 \tag{3}$$

The preliminary decision table comprising standard information creates the distinction matrix and diminishes the qualities. Consumers often focus on the "definition, assistance, and transportation" indications, product specifics, cumulative evaluations, and transactions upon accessing the main page of a product presentation. The paper compiles consumer authorization data, order specifics, logistics specifics, and payment data, analyzing purchase behavior concerning clients, products, orders, and transportation to detect anomalous risky financial behaviors associated with e-commerce goods in Peru. The architecture of the CNN approach for identifying anomalous FM in e-commerce is illustrated in Figure 1.

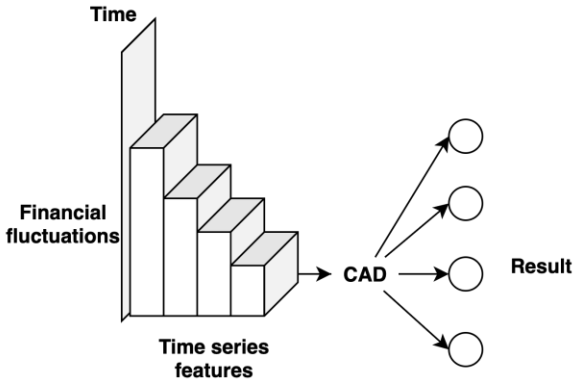

Figure 1: The Architecture of the Fm based e-commerce Model

The procedure follows: the three-dimensional structure's geometric characteristics are quantified, yielding the 2D descriptors fed into a deep belief network for categorization. The removal phase of the 2D description is as follows: The 3D model is separated, resulting in its surface comprising triangular areas. Randomness individual points are produced on the outermost layer of each triangular patching, and the Euclidean space among any two points is computed to derive the likelihood distribution levels of the 3D approach. In CNN, the components of a weighted matrix are typically utilized just once and not reused. Each element will influence every aspect of the source. This variable sharing enables the extraction of features by learning a singular collection of variables rather than individual variables. This approach optimizes the settings. A 2D interval series is derived via statistical data analysis. The equation (4) is given as,

$$f_1(Q_N)f_2(Q_N) \tag{4}$$

The recognition of financial hazards in e-commerce commodities trading is converted into recognizing anomalies in 2D historical data. The time series data points are fitted with broken lines, identifying the abnormal points along these lines. Digitize the commodity-related data, precisely determine the commodities associated with the weird facts, and locate the appropriate commodity using the commodities. During the data processing phase, data about shops and products is digitized to enhance processability and guarantee the correctness of final placement.

The ML network classification has one input level, four concealed levels, and one output level, with the respective quantities of neural units. The approach designates a label for every anchoring point to train the system and executes multi-classification activities using a Softmax classification.

The storage format for 3D models in computers is triangular regions, and voxelization is converting these mathematical representations through voxel symbols for 3D spaces. The significance of a binary voxel algorithm is contingent upon the occupancy of the voxel area by the modeling. If a voxel is filled by the 3D method, its value is 1. If the model is absent from the voxel area, the value is 0. The range of multivalued voxelization is between 0 and 1. As the learning set of the detection algorithm is augmented and refined, the algorithm will assimilate new financial danger patterns associated with anomalous purchasing of e-commerce items, enhancing detection reliability.

2) Identification of Abnormal Activities

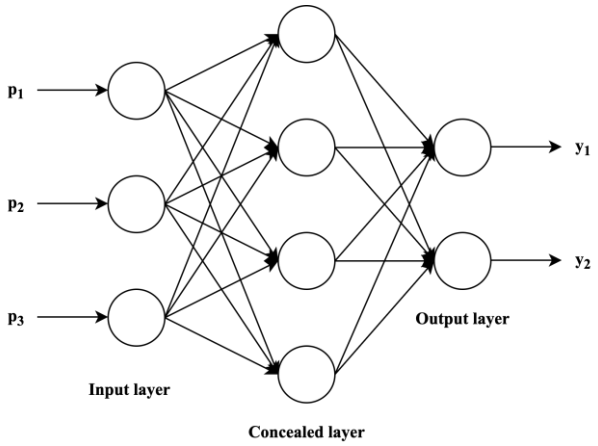

Figure 2: BPNN-based FM Model for Abnormal Activities Identification

The fundamental architecture of the Back Pressure Neural Network (BPNN) architecture is illustrated in Figure 2. It demonstrates that the BPNN primarily comprises the input, concealed, and output components. The activating function articulates the requirements across levels, simulating the interactions among neurons within every level. The often employed activating function is the sigmoid function, which ensures the ongoing existence of the first derivatives. For a training sampling $P = \{p_1, p_2, \cdots, p_{N-1}, p_N\}$, the networking level comprises a weighted matrix $B = \{b_1, b_2, \cdots, b_{N-1}, b_N\}$, and the associated data source is articulated as follows. The equation (5) is given as,

$$Input = p_1 b_1 + p_2 b_2 + \cdots + p_{N-1} b_{N-1} + p_N b_{N-1} \quad (5)$$

The overall error energy E is derived from the disparity between the anticipated and actual results produced during network activity, as illustrated below. The equation (6) is given as,

$$E(k) = \frac{1}{2}\sum_{y=0}^{N-1}\left(D_{Ny} - O_{Ny}\right)^2 \quad (6)$$

Let x represent the number of repetitions in the training procedure, and O_{Ny} denote the final result value. The calculating formula $O_{Ny} = \{o_{11}, o_{12}, \cdots, o_{xy}\}^T$, and the resulting prediction $D_{Ny} = \{d_{11}, d_{12}, \cdots, d_{xy}\}^T$, where k represents the inputting message at the inputting level, y denotes the total number of messages at the resulting level, and N signifies the most significant number of repetitions.

The S-type activating mechanism is a curve with a value range between 0 and 1. It allows us to forecast the group to which the data set belongs probabilistically. The resultant formula of the sigmoid activating value, wherein y is the result vector of the neural networks, and exp signifies the anticipated precision and the equation (7) is given as,

$$Output = \frac{1}{1+\exp(-input)} \quad (7)$$

The error factor is computed based on the disparity between the actual and anticipated results vectors. The equation (8) is given as,

$$err = \frac{1}{2}\sum_{x=0}^{N-1}(E(i) - A(i))^2 \quad (8)$$

E represents the predicted output matrix; A denotes the actual output matrix; i signifies the most significant number of repetitions; x refers to the input level containing the incoming signal, and N indicates the number of entries in the outputting level.

Data standardization is a prevalent technique in data processing, wherein all information is transformed into numerical values within the range [0, 1], therefore mitigating the magnitude discrepancies across different dimensions and preventing significant variations among input and output information. The average variance approach is employed, and the variable is articulated as follows. The equation (9) is given as,

$$p_i = \frac{p_i - p_M}{p_V} \quad (9)$$

p_i represents a learning sample; $p_M$is the average of the data sequences; and p_V signifies the variation. The model establishes a minimum weighted attenuation rate of 0.5, an overall iteration limit of 200, and specifies eight nodes in the concealed level. The constructed model is a 9-8-2 neural network, including a source layer with nine nodes, a hidden layer with eight nodes, and a result layer with two nodes. This research's user fraud recognition approach, constructed using a BPNN, encompasses variable assessment, data preprocessing, modeling assessment, information mining, statistical verification, model recognition, and risk assessment.

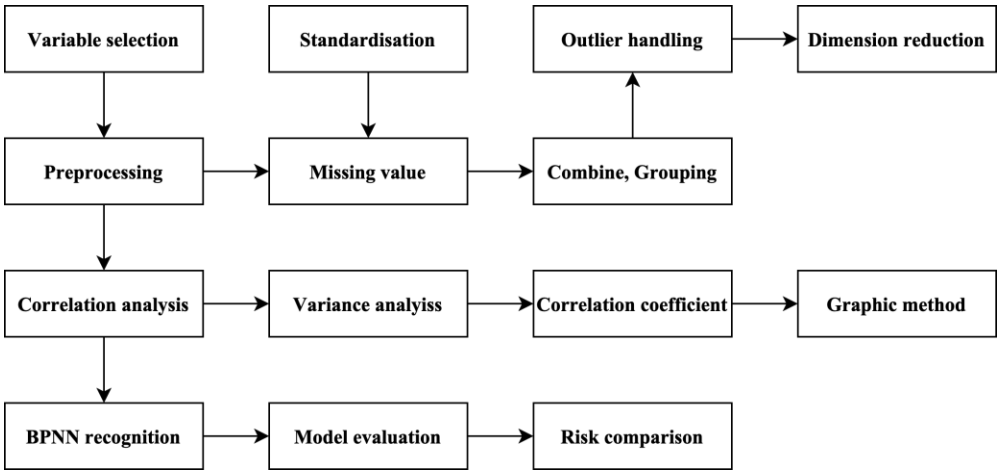

Figure 3: Abnormal Activities Identification Model for BPNN

This research's primary variables are user, credit, transaction, and consumption information. Before model development and data evaluation, it is essential to standardize data, address missing values, perform data combining and arranging, and manage outliers. A BPNN is employed for data identification following the graphical and correlation analyses to examine data relationships. The framework is ultimately assessed, and the associated risk is evaluated. The technique of identifying customer fraud via a BP neural network is illustrated in Figure 3.

3) Factors Influencing Customers' Characteristics

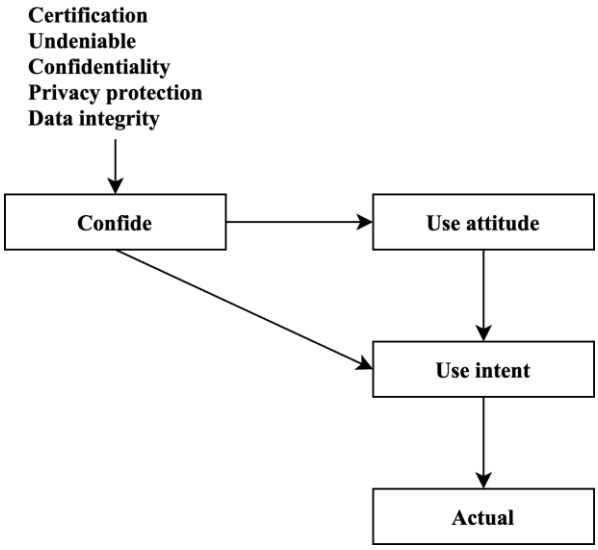

Figure 4: Factors Influencing FM in Mobile Networks

User trust is employed as an intermediary parameter to investigate the elements influencing finance utilization to develop the relevant model in Peru. Security management is a crucial metric for establishing trust in financing, encompassing encryption keys, third-party authorization, and digital signatures. The framework of financial behavior primarily encompasses security control magnitude, user confidence, consumer mindset towards financing, and user desire to utilize the funding, as seen in Figure 4.

The subsequent assumptions are provided according to the model above: A(The perceived safety, identity authorization, non-repudiation, anonymity, safeguarding privacy, accuracy of data, and control power significantly influence users' confidence in Internet money amenities), B(Users' trust benefits their attitude regarding financing), C(Users' trust positively impacts their intention to utilize the funding), D(Users' attitude regarding banking benefits their intention to engage with it), and E(Users' desire of employing financing positively correlates with their actual usage).

A survey is constructed based on the criteria above. The participant completes the questionnaire autonomously in a confined setting. The survey comprises (1) a concise overview of this investigation, detailing its research goal and the methodology for handling confidential facts; (2) the demographics of the participants (gender, age, profession, etc.); (3) the factors pertinent to this studies (authentication technological advances, non-repudiation, anonymity, safeguarding privacy, reliability of data, trust perception, usage behavior, intention to utilize, and actual consumption) in Peru. The Likert 5-point scale assigns scores for every index as follows: "1" indicates entire disagreement, "2" signifies slight dispute, "3" represents neutrality, "4" denotes slight agreement, and "5" reflects absolute agreement.

4 Results and Discussions

This research developed an FM for the e-commerce system to examine the impact of financial model administration by examining the oversight approach and financial, and operational risks associated with e-commerce financing in Peru. The enhancement of the financial fund accounting software and the optimization of the inside staff's accounting capabilities resulted in enhanced financial operational efficiency of the e-commerce system. This article initially examined the happiness levels of three major financial organizations about the economic framework of the e-commerce system, surveying 100 individuals from each firm in Peru. The particular satisfaction impacts are illustrated in Table 1.

Table 1: Customer Satisfaction Result Analysis of FM

	Satisfaction	**Neutral**	**Dis-satisfaction**
Company 1	84	10	6
Company 2	87	7	8
Company 3	89	5	9
Total	260	22	23

The data presented in Table 1 indicates that workers of the three financial firms expressed high satisfaction with the e-commerce system. Company 1 had 84 pleased workers, representing 84% of its workforce. Six individuals were dissatisfied. Company 2 had 87 pleased workers, representing 87% of its workforce. The mean number of individuals was 7, representing 7% of the company's overall count. Eight individuals were dissatisfied. Company 3 had 89 pleased workers, representing 89% of its workforce in Peru. The mean number of individuals was 5, representing 5% of the company's overall count. The count of disgruntled individuals was 9, representing 9% of the company's population. Content, financial enterprise personnel asserted that implementing the FM on the system could enhance the accounting of platform resources and the efficacy of financial data administration and facilitate the real-time collection of transaction data from the system in Peru. The financial risk and operational danger of the e-commerce system inside the economic model were assessed. The particular modifications are illustrated in Figure 5.

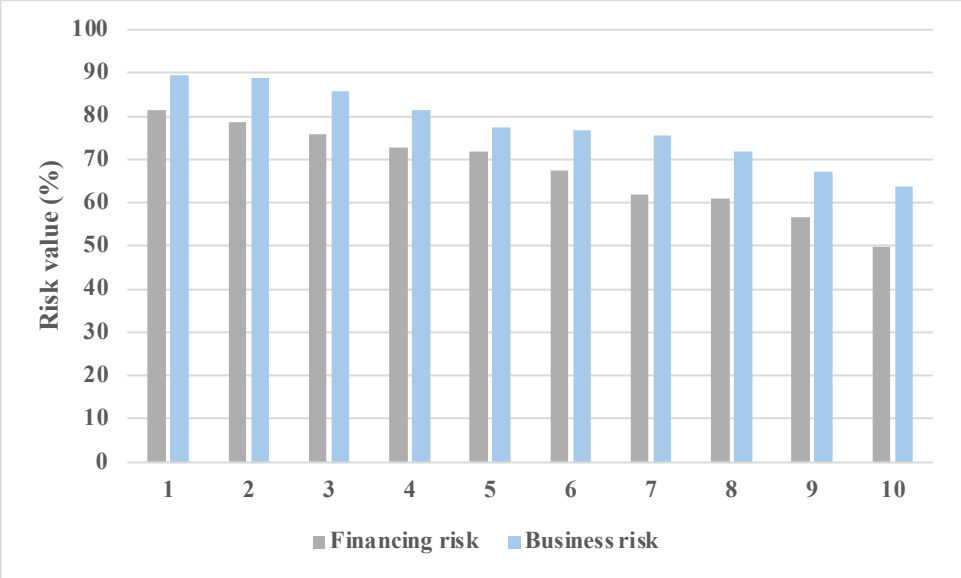

Figure 5: FM-based Risk Analysis Model

The analysis shown in Figure 5 indicates that the risk associated with the finance and operational risk of the platform has been progressively diminishing under the economic model of the e-commerce system in Peru. The mean finance risk was around 61%, whereas the mean risk of operation was roughly 72%. The starting value of platform finance risk was 79%, which diminished to 31% on day seven, resulting in a total drop of 67%. The system's initial operational danger value was 8%1, which decreased to 52% on day 7, reflecting an overall reduction of 47% during the entire procedure in Peru. The primary reason is that the financial information of the e-commerce system is immutable, and the data protection is relatively robust. Access is restricted to authorized users, and the accuracy of risk prediction has been enhanced following the improvement of the FM. The ML technique was employed to evaluate the classification value and the security factor of the platform's FM, and the variation in their information over a week was examined. The particular modifications are illustrated in Figure 6.

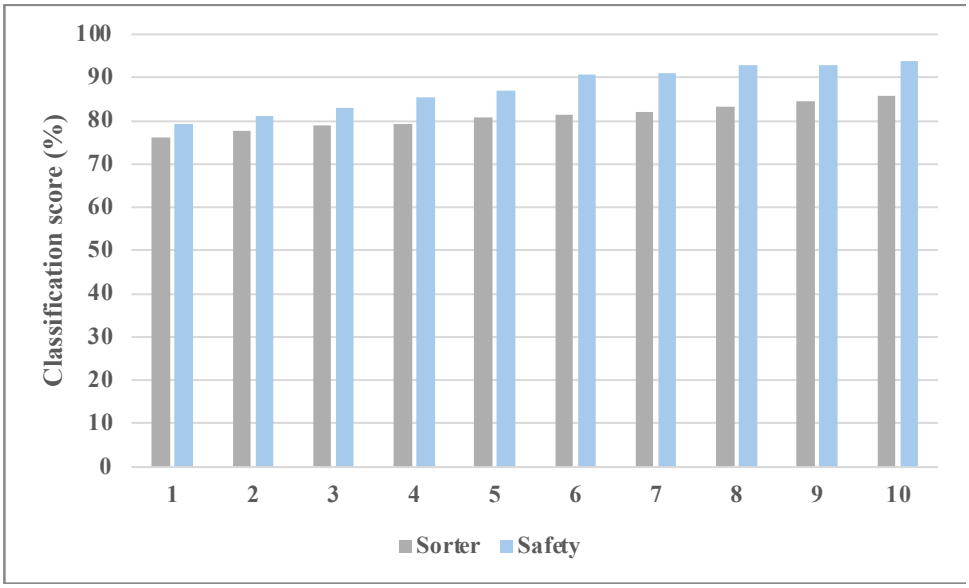

Figure 6: Classification Result Analysis

Data analyzed in Figure 6 indicates that the classification value and safety element of the e-commerce system FM progressively improved under the ML method. The average classification value was 81.2%, whereas the average risk factor was 78.3%. The starting classification value of the system's FM was 87.2%, which rose to 89.21% on day seven, resulting in an overall rise of 62.3%. The original security ratio of the platform's FM was 86.43%, which grew to 79.4% on the seventh day, resulting in an overall rise of 63.1%. The increase in classification value indicated that the e-commerce platform's banking mechanism was more robust, and its accounting strategies were more varied. The increase in the security factor suggested that the system's FM was more intricate and cohesive regarding financial accounting regulations, leading critical financial personnel to prioritize financial information, thus enhancing the secure functioning of the e-commerce system in Peru. The confidentiality of transactional data and the precision of the accounting processes inside the e-commerce system's FMs were studied in relation to the original FM of the e-commerce system. The particular contrast is illustrated in Figure 7.

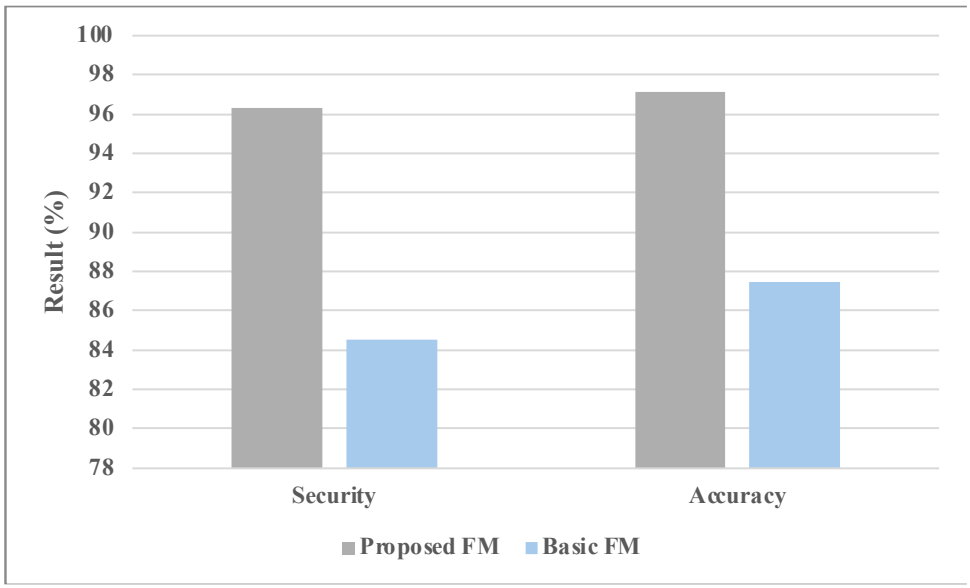

Figure 7: Safety and Reliability Analysis

Data shown in Figure 7 indicates that the transaction safety and accounting reliability of the e-commerce system accounting framework surpassed those of the initial FM. The safety of data on transactions exceeded the initial FM by 16.2%, while the reliability of financial accounting surpassed the initial FM by 8.5%. The accounting and capital operating system criteria on the e-commerce platforms were more defined, and the accounting records about activities were more transparent in Peru. The system's imported and exported volume of transaction records is analyzed, documented, and compared using its financial database, enhancing the reliability and safety of the platform's financial information to some degree. Developing the FM framework for the e-commerce structure is crucial for improving the system's accounting for funds and integration of resources capabilities, as it standardizes financial information tracking and estimation, thereby enhancing the finances of the financial structure.

5 Conclusion

The fast advancement of e-commerce presents both benefits and problems. The e-commerce platform must function as a perpetually improved FM, with financial management of paramount importance. The system's internal finance staff must enhance their overall competence and augment their expertise to

devise e-commerce strategies in response to market fluctuations effectively. ML can improve the fund accounting capabilities and integration of resources in the system. The experimental research demonstrates that the e-commerce model developed in this work enhances data security about transactions, improves the reliability of FM, and mitigates the risks associated with enterprise systems. Mechanisms can be implemented to mitigate some financial hazards in the e-commerce system in Peru using mobile networks. E-commerce's positive growth can only be enhanced by appropriately managing financial risks. To enhance e-commerce's efficiency and increase economic advantages, it is essential to diligently examine its accounting strategies and refine the corporate structure of FM. Only through the continual enhancement and optimization of accounting strategies using mobile networks can the FM catalyze e-commerce's advancement in Peru.

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