

Role of Artificial Intelligence in Financial Fraud Detection: A Conceptual and Analytical Review

¹Dr Devadutta Indoria, ^{2*}Dr K Devi

¹First Author -Dr Devadutta Indoria, Head ,P.G.Department Of Commerce, Vikram Dev University, Jeypore,Odisha-764001,
E-mail -mailmedevdutt@gmail.com,
ORCID -0000-0002-4556-9458

^{2*}Corresponding Author -Dr K Devi ,Head , Department Of Commerce ,D.A.V Autonomous College, Titilagarh, Odisha-767042
E-mail- deviindoria6666@gmail.com
Orcid-0009-0003-2364-647X

ABSTRACT:

Ensuring the security of financial sectors by detecting the frauds is one of the most essential problems need to be addressed in ancient times. Generally, the AI is defined as a kind of digital technology that offers an innovative and intelligent business solutions for increasing the growth and security of financial institutions. Moreover, it reshapes the entire business strategies and operations for automation, which helps to avoid the human interruptions by acting like a human. Specifically, the AI is highly effective that suggests the perfect and proper decisions for avoiding the fraudulent activities in the financial institutions. In addition to that, it helps to obtain an increased customer service by providing the good quality of service/products to them according to their specific requirements and demands. This work objects to analyze that how AI could be more useful for the financial service providers to detect the frauds. Also, it investigates the regulations, roles, and opportunities of using AI technology in the financial institutions. Moreover, it provided some unique and intelligent solutions to the proper organization management and control. During performance analysis, the major impacts of using AI technology in the financial institutions are validated according to the recent reviews.

Keywords: *Fraud Detection; Artificial Intelligence (AI); Financial Sector; Risk Management; Applications of AI; Digital Technologies.*

INTRODUCTION

Due to the rapid development of internet and information technologies, the Artificial Intelligence (AI) [1-3] is highly popularized and extensively used in many industrial sectors. Specifically, it gained significant attention in the financial sectors [4,5] for preventing it from the fraudulent events. Typically, the AI is one of the digital technologies, which provides innovative and intelligent business solutions for business growth and development. It avoids the human interruptions by automating the system operations, and also it acts like a human. In the financial industries [6-8], the main reason of deploying the AI technology is to deliver the reliable and quality products to the customers with ensured safety and security. Moreover, it searches some specific and unique ways for attracting the customers with reduced time cost and computational cost [9, 10]. In addition to that, it targets to obtain the better customer experience support by efficient management and supply chain operations. The general uses of AI in the financial industries are represented in Fig 1.

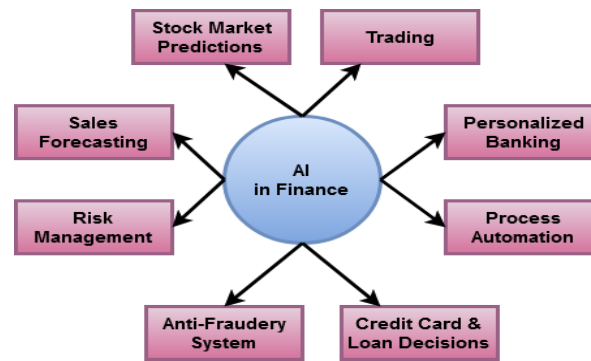


Figure 1: Uses of AI in financial sectors

In the financial sectors, the AI provides the suitable solutions for the following operations [11-13]:

1. Cybersecurity [14]- It prevents the organization from the malicious access or attacks by ensuring the security properties like confidentiality, privacy, safety, and integrity.
2. Compliance [15, 16]- It automates the compliance effects by providing the innovative solutions to resolve the problems. Also, it allows the financial sectors to monitor and control the risk operations by using some specialized automated AI assisted software.
3. Fraud Detection [17, 18] – According to the recent reviews, it is proved that the AI is highly effective that takes the perfect and proper decisions for avoiding the fraudulent activities in the financial institutions.
4. Better customer service [19, 20]- AI mainly objects to satisfy the organizations’ customers by analyzing their business requirements and specifications. Also, it learns the history of information for providing the good quality of services to the customers. Specifically, it does not require any human interruptions for obtaining the customer satisfaction, and it enables the valid and trusted communication with the customers.
5. Trading [21, 22]- It is more helpful for improving the business trading by mining the data from the knowledge. Also, it recommends the best policies and solutions for the increasing the sales of financial products.

The major research objectives of this work are as follows:

- To analyze the major impacts of deploying the AI technology for detecting the financial frauds.
- To discuss the benefits and key challenges associated to the incorporation of AI in the financial sectors.
- To investigate about how the AI could improve the security of financial organizations against the frauds, and how it supports the risk management system.
- To study the innovative solutions and applications provided by the AI to the financial sectors.
- To validate the results of AI deployment in the financial institutions by using various evaluation indicators.

The remaining units of this paper are structured into the followings: Section II reviews the conventional works related to the deployment of AI in the financial sectors. Then, the major impacts of using AI in the financial industries for fraud detection is clearly investigated in Section, and it also discusses the advantages and challenges correlated to the incorporation of AI in Section III. The results of using AI for fraud detection in the financial sectors are validated in Section IV. Finally, the overall paper is summarized with the findings and future work in Section V.

Related Works

This section reviews the major role, uses, applications, challenges and opportunities of implementing the AI based digital technology in the financial sectors. *Soni, et al [22]* investigated about the major role of deploying AI methodology in the banking sectors. The main purpose of this work was to detect the cyber threats in the financial sectors by using an advanced digital technology. Here, an automated Robo-advice platform was implemented with the support of AI technology, which helps to identify the frauds in the banking sectors. Due to the rapid development of communication and internet technologies, the different types of security issues could arise in the financial industries. Hence, an AI based digital technology was developed to minimize the cybercrimes by securing the information technology. In addition to that, it highly minimizes the human intervention with better customer satisfaction, and ensured system security. *Pallathadka, et al [23]* investigated about the key applications of using AI technology in the e-commerce and financial industries. Here, the main difference between the machine learning and deep learning techniques have been provided. *Xie, et al [24]* objects to analyze the development and application of using AI technology for the financial sectors. The purpose of this paper was to examine the advantages and challenges in the deployment of AI technology in financial sectors. Based on this study, it was analyzed that the AI has the positive impacts in the field of financial risk management. *Guidici, et al [25]* investigated about the major impacts of using three different digital technologies such as AI, blockchain, and big data for ensuring the better risk management in the financial industries. The main

contribution of this work was to support the development and growth of financial sectors by using the digital technology. Moreover, this work mentioned that the cyber-security management was one of the important concerns should be guaranteed in the financial institutions.

Ryman, et al [26] conducted a detailed survey for analyzing the effects of using AI technology in financial fraud detection applications. Here, the new framework was developed for fraud detection management and controlling. Malali, et al [27] provided a detailed overview about the utilization of AI technology for improving the developmental growth and ensuring the security of financial industries. The main purpose of this work was to investigate the major dynamics of using AI technology for financial business applications. Truby, et al [12] suggested a proactive approach for analyzing the effects of AI in the banking sectors. This work objects to analyze that how the AI could be more useful for the financial service providers. Also, it investigated the regulations, roles, and opportunities of using AI technology in the financial institutions. Here, the FinTech paradigm was considered for analysis, where the AI supports to increase the delivery of financial services or products. Moreover, it discussed about the core elements of using AI as shown in Fig 2.

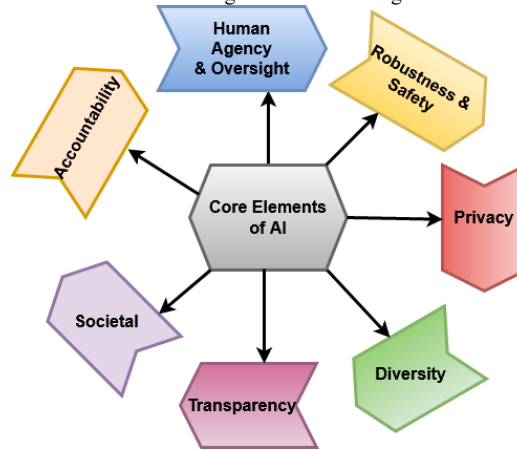


Figure 2: Core elements of using AI

Table 1 discusses about the different types of AI methodologies used in the financial industries with the corresponding area of applications.

Table 1: Use of AI methodologies in the financial sector

Purposes	Area	Methods
Financial network [28, 29]	Progression of financial net	1. Multilayer perceptron models 2. Probabilistic machine learning 3. Economic theory 4. Complex theory
	Risk Acquaintance	1. Bayesian networking models 2. Multivariate networking models 3. Conditional models 4. Distorted probability estimation models
	Financial net & real economic	1. Dynamic stochastic models 2. Weighted directed graph Construction 3. Equilibrium
	Financial net structure development	1. Neural Network 2. Multilayer perceptron model
Sentiment analysis in marketing [30, 31]	Systematic risk analysis & correlation matching in financial sectors	1. Big-data analytics 2. Bayesian methods 3. Fuzzy systems
	Sentiment analysis	1. Big-data analytics 2. Text mining 3. Rule-based models 4. Regression & classification techniques
Stability improvement [32, 33]	Financial market – microstructure enhancement	1. Statistical modeling 2. Agent based financial modeling 3. Conditional-risk model
	Systematic risk management & financial tools	1. Logistic regression 2. Regression model 3. Simulation analysis
Financial regulation [1, 34, 35]	Quantitative analysis	1. Best-cost statistical analysis 2. Correlation analysis 3. Comparative study

Research Methodology

This section studies the major effects of applying AI technology for detecting the frauds in the financial sectors. Also, it presents the details related to the applications, benefits, and challenges exist in the deployment of AI. Typically, the AI is one of the most popular and emerging digital technology extensively used in many industries and business application systems for increasing the business growth and development. Moreover, it some provided some unique and intelligent solutions to the proper organization management and control. Hence, the proposed work objects to implement the AI technology for increasing the security of financial sectors by preventing it from the frauds. The main uses of AI in the banking systems are shown in Fig 3.

Channel	Front Office	Middle Office	Back office
Size of	\$ 199B	\$ 217B	\$ 31B
Key Usecases	Chatbots	Anti-Fraud & Risk	KYC/AML
	Voice Assistance	Bio Metrics	Legal & Complex Work Flow
		Monitoring	Credit Underwriting
			Smart Contracts Infrastructure

Figure 3: Uses of AI in banking systems

Major Impacts of using AI. The main contribution of this work is to analyze the major impacts of using AI technology in the financial industries for fraud detection. The key features of using AI in the financial sectors are depicted in Fig 4.

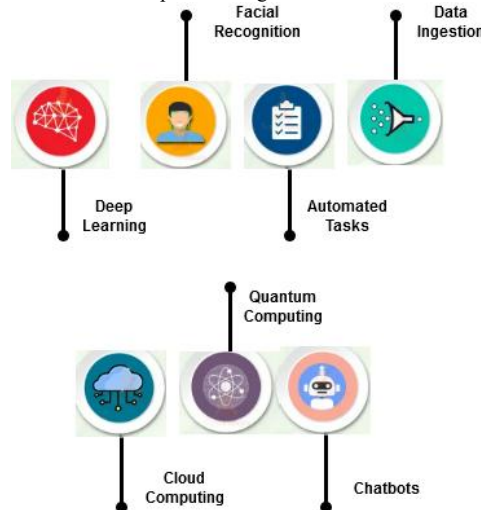


Figure 4: Key features of AI

Typically, the AI is mainly used for the following purposes:

- Increased customer interaction and experience – It highly supports the business people for improving the customer service support, enabling the biometric authentication, chatbots assistance, voice banking and etc.
- Better performance efficiency - It enables an automated system operations like data extraction, process optimization, control & management, and documents segregation.
- Ensured security and Risk control – One of the important reason of using AI technology is, it highly guarantees the data security and risk control. Also, it has an increased ability to detect the financial frauds and to prevent the organization from the cyber-risks.

Applications of using AI

The AI is more useful for the financial sectors to detect the financial frauds, and it supports the followings:

1. **Image search:** It is a type of website searching and developed based on the AI based image processing algorithms. It helps the customers to search their items through images, and it does not any require any specific keywords. It also targets to obtain an increased customer satisfaction rate by providing the reliable services what they actually required.
2. **Chatbots :** It is one of the website used in the financial institutions for increasing the customer satisfaction by analyzing their actual requirements. It is entirely developed based on the AI and ML methodologies, which identifies the major requirements/specifications of the customers for providing the reliable and quality services to them. Moreover, it acts like a human that provides the feasible solutions and best recommendations to the customers by enabling the convenient communication with them.
3. **Recommendation systems:** It analyzes the customers’ past data like customer behavior, choice, requirement, and etc for suggesting the suitable and best product/service recommendations. It is developed by using the machine learning algorithms such as Artificial Neural Network (ANN), Bayesian Networks (BN), Ensemble Learning (EL) classifiers, and Deep Learning (DL) models. Most of the financial sectors could use the AI technology for increasing their sales and customer satisfaction rate.
4. **Customer data handling:** Customer data handling is one of the most essential property of using AI technology, which helps to obtain the better customer satisfaction rate by fulfilling their actual needs. Specifically, it supports some automated business tools for enabling the reliable communication with the customer, which increases the customer satisfaction rate. The overall organization growth and development is highly depends on the customers, hence it is very essential to satisfy the customers by providing the good quality of financial products/services to them according to their specifications.
5. **Credit scoring:** Credit scoring is mainly estimated with respect to the data of income, revenue, profit, transaction details, and etc. The AI supports some of the statistical modeling approaches for estimating the credit score. Generating the credit report is one of the effective solutions for calculating the credit score.
6. **Inventory management:** The AI technology supports the financial sectors to make the proper decisions about the inventory. It is highly helpful to obtain an increased profit earnings and reduced losses in the business operations. Typically, the AI can reshape the entire business policies and operations with new and intelligent ideas and solutions. Also, the automated business activities make the inventory management as pre-planned, successful, and efficient. The major aspects of AI based inventory management are as follows:
 - Utilization of appropriate and reliable technology
 - Perfect and accurate data organization
 - Efficient business profit and earnings estimation
 - Innovative solutions for the appropriate problems

7. **Cyber-security**

Among other parameters, the cyber-security is one of the most important and demanding factor need to be addressed in the financial sectors for ensuring the security of operations. It accurately spots the system vulnerabilities for providing the suitable solutions to keep the platform as more secured. Hence, most of the financial industries highly prefer the AI for an efficient fraud prevention and detection. In recent times, the different types of AI based security approaches are developed, which guarantees the secured system operations by restricting the user access control policies.

Deployment of AI in Financial Sectors

In the financial sectors, the AI is mainly used for the different purposes as shown in Fig 5.



Figure 5: Key applications of AI in the financial sectors

Fraud Detection and Control

Among other applications, fraud identification and detection is one of the most essential and imperative factor for the deployment of AI in financial institutions. Most of the industrial organizations intend to reduce the risks associated to the business processes. Specifically, it is well suited for the financial sectors, since which highly deals with the payments and deposits. Moreover, the AI based fraudulent detection is treated as the serious issue in the financial sectors, because which helps to minimize the financial pollutions. According to the recent reviews, it is analyzed that the AI is considered as the topmost and emergent digital technology that is developed for the strengthening the security of business operations. Moreover, it predicts the fraudulent events by accessing the earlier spending patterns and behavior of each user transaction. In addition to that, the most important aspect of using AI is, it identifies the frauds by learning the things according to the previous experience. Based on the learning, it takes some automated and intelligent decisions for spotting the frauds.

Risk Taxation

The AI technology could entirely replace the human interventions for enhancing the business activities with reduced cost consumption. Moreover, it offers the following benefits: high accuracy and ability to handle large dimensional data. Also, it enables the reliable and valid communication among the entities, in which the AI-assisted chatbots is proved as the potential technique that supports the best customer care. This kind of innovative technology not only enhance the business activities, but also ensures the better non-commercial operations.

Managing Finance

Finance management is one of the challenging tasks for both people and business holders. Since, the deployment of AI enabled technologies is one of the suitable option for the fund management field. Moreover, it provides the support to the customers for making an efficient and smart decisions at the right time. For this operation, it generates the spending graph by using the data obtained from the web source.

Automated Decision Making

It automates the business management decisions with minimal cost consumption, hence most of the financial institutions highly recommend the AI assisted digital technologies. Specifically, it has an increased ability to handle the large volume of data, which is more helpful for the business managers and other people to make the suitable decisions at the proper time.

Customer Support

Automated customer is the key feature of AI technology, which entirely replaces the conventional customer care policies and operations with the use of AI-assisted digital technologies like chatbots, text chats, and etc. By using these features, it efficiently satisfies the customer requirements by analyzing their actual needs. Also, it provides the complete support to the customers with reduced cost, energy and time. It targets to provide the reliable and trustable services to the customers by enabling the proper communication with them. The customers are also more flexible and convenient with the AI based technologies.

Predictive Analysis

The prognostic analysis is a kind of predictive analysis that plays a vital role in the financial institutions, which helps to enhance the increase the business sales, turnover rate, profit revenue, and optimal resource usage. Also, it provided the customized and well-organized solutions to the management team for predicting the business solutions.

AI based Risk Management and Controlling

Due to the technological development and growth, there may be an increased possibilities for the business risks, which disrupts the entire business operations. Here, the AI based methodologies are considered as the suitable option for controlling and managing the risk factors associated to the financial industries. In which, the banks and insurance companies are operated in a modest and intricate business policies. Hence, ensuring the customer loyalty is one of the essential factor need to be addressed, which mainly depends on the factors of trust, perceived value, and commitments. The primary advantages of using AI technology for financial fraud detection are shown in Fig 6.

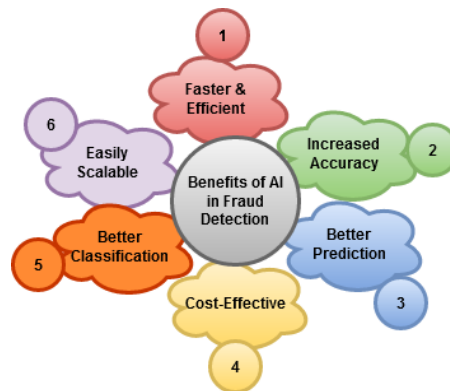


Figure 6: Advantages of using AI for financial fraud detection

Results and Discussion

This section validates the performance and results of AI technology used in the financial sectors based on various evaluation indicators. The main purpose of this research work is to deploy the AI technology for detecting the frauds from the financial sectors. Generally, AI provides an intelligent and innovative solutions for automating the business processes and controlling operations. Moreover, it has an increased ability to predict the unknown events in the financial institutions for ensuring the security. Fig 7 validates the AI based business value forecasting analysis for the years of 2017 to 2025. By using this analysis, the major effects of using AI technology is validated based on the factors of decision support/augmentation, automated decision support, agents and smart products delivery. The obtained results indicate that the AI gained a significant attention in current days, due to their effective decision-making capability and innovative solutions. Hence, most of the financial industries are willing to adapt the AI for increasing the system security against the financial frauds.

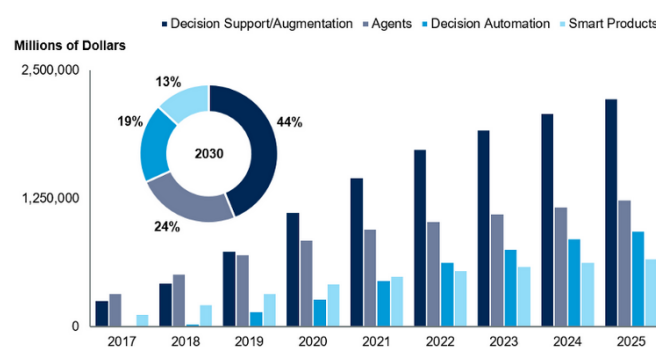


Figure 7: AI based business value forecasting

Fig 8 shows the different types of applications supported by the AI technology for improving the growth and development of financial institutions. It includes the technologies of Natural Language Processing (NLP), chatbots, blockchain, data lakes, AI/Machine Learning (ML), External data integration, Robotic process automation, mobile finance, and predictive analysis. According to the percentage of respondents, it is analyzed that the AI could be more reliable and suitable for the financial sectors. Moreover, it entire restructure the business strategies and policies for obtaining the increased customer support and business growth. Fig 9 depicts the share of investments in the banking sectors for the year of 2020. For this analysis, the AI supported methodologies such as ML, predictive analysis, virtual assistant, image analysis, NLP, and robotic process automation have been considered, where the impact is evaluated with respect to the percentage of respondents. Based on the results, it is evident that the AI is highly deployed in all the financial sectors for ensuring the security and safety. In addition to that, it enables the trusted communication with the customers for analyzing their business needs and requirements.

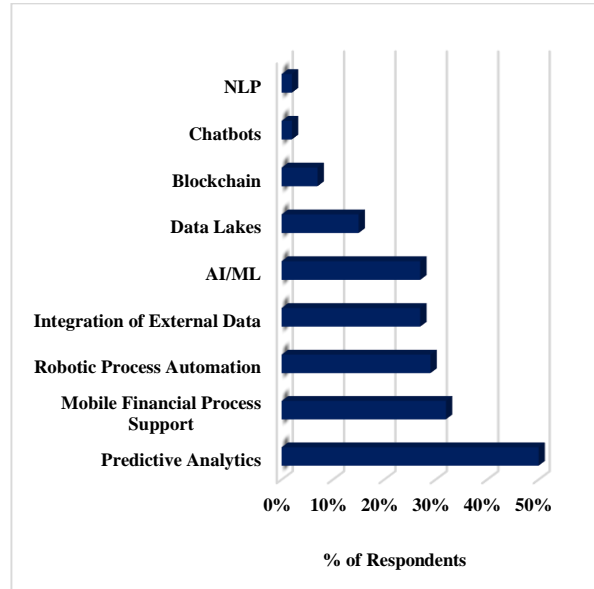


Figure 8: Deployment plans of financial technology

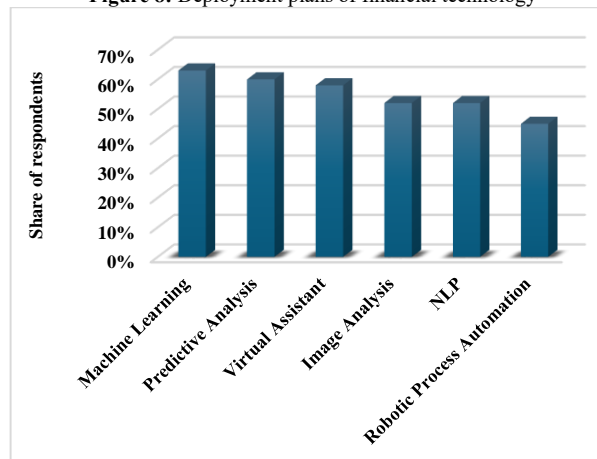


Figure 9: Share of investments in the banking sectors with the deployment of at 2020

Fig 10 validates the use of AI for risk management in the financial sectors based on the factors of self-created analytics, credit reports, third party data & analytics, ML, blockchain, automated risk decisions, and economic data. Due to its increased decision-making ability and support, it efficiently handles the risks in the financial sectors by providing the appropriate and unique solutions. Fig 11 shows the fraud detection percentage by risk for the year of 2021. According to this analysis, it is analyzed that the AI technology can efficiently detects the frauds based on the automated decision-making capability.

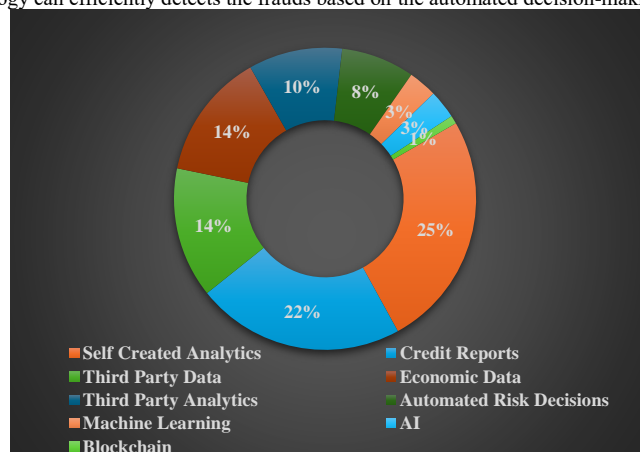


Figure 10: Use of AI for risk management in financial sectors

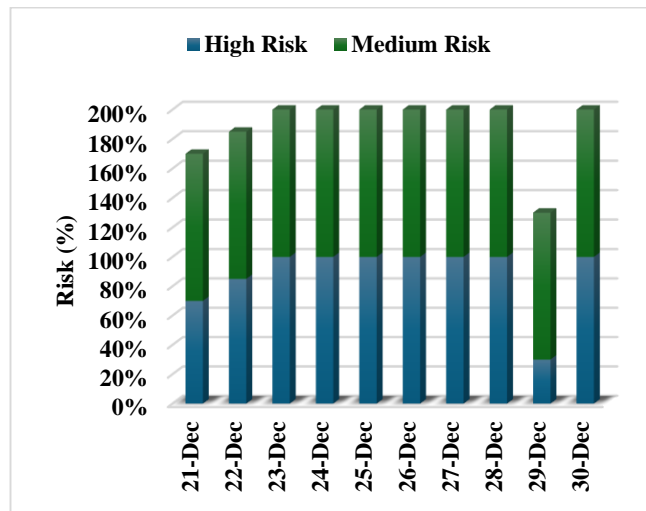


Figure 11: Risk analysis during 2021 using AI

Conclusion

The main purpose of this paper is to conduct an empirical analysis for detecting the financial frauds by using the AI technology. Due to the rapid development of communication and internet technologies, the different types of security issues could arise in the financial industries. This work objects to analyze that how the AI could be more useful for the financial service providers. Also, it investigated the regulations, roles, and opportunities of using AI technology in the financial institutions. Typically, the AI has a significant attention in recent times due to its innovative decision-making support and ability. Also, most of the financial industries intend to incorporate the AI technology with their business strategies for increasing the profit growth, and security. Among other factors, ensuring the security of financial institutions is one of the most essential tasks need to be addressed in the current days. Moreover, the AI provides some unique solutions to identify the fraudulent events for strengthening the system security. In addition to that, it supports to accomplish an increased customer interaction and experience, better performance efficiency, ensured security and risk control. It enables an automated system operations like data extraction, process optimization, control & management, and documents segregation. Then, it highly guarantees the data security and risk control. Also, it has an increased ability to detect the financial frauds and to prevent the organization from the cyber-risks.

REFERENCES

[1] A. Lui and G. W. Lamb, "Artificial intelligence and augmented intelligence collaboration: regaining trust and confidence in the financial sector," *Information & Communications Technology Law*, vol. 27, pp. 267-283, 2018.

[2] A. Fernández, "Artificial intelligence in financial services," *Banco de Espana Article*, vol. 3, p. 19, 2019.

[3] T. Dhanabalan and A. Sathish, "Transforming Indian industries through artificial intelligence and robotics in industry 4.0," *International Journal of Mechanical Engineering and Technology*, vol. 9, pp. 835-845, 2018.

[4] T. C. Lin, "Artificial intelligence, finance, and the law," *Fordham L. Rev.*, vol. 88, p. 531, 2019.

[5] N. R. Moşteanu, "International Financial Markets face to face with Artificial Intelligence and Digital Era," *Theoretical & Applied Economics*, vol. 26, 2019.

[6] P. Makhija and E. Chacko, "Efficiency and advancement of artificial intelligence in service sector with special reference to banking industry," in *Fourth Industrial Revolution and Business Dynamics*, ed: Springer, 2021, pp. 21-35.

[7] V. Kanimozhi and T. P. Jacob, "Artificial intelligence-based network intrusion detection with hyper-parameter optimization tuning on the realistic cyber dataset CSE-CIC-IDS2018 using cloud computing," in *2019 international conference on communication and signal processing (ICCSP)*, 2019, pp. 0033-0036.

[8] L. Kruse, N. Wunderlich, and R. Beck, "Artificial intelligence for the financial services industry: What challenges organizations to succeed," in *Proceedings of the 52nd Hawaii International Conference on System Sciences*, 2019.

[9] A. Jabłonowska, M. Kuziemski, A. M. Nowak, H. W. Micklitz, P. Pałka, and G. Sartor, "Consumer Law and Artificial Intelligence: Challenges to the EU Consumer Law and Policy Stemming from the Business' Use of Artificial Intelligence-Final report of the ARTSY project," *EUI Department of Law Research Paper*, 2018.

[10] E. Mogaji, T. O. Soetan, and T. A. Kieu, "The implications of artificial intelligence on the digital marketing of financial services to vulnerable customers," *Australasian Marketing Journal*, p. j. ausmj. 2020.05. 003, 2020.

[11] B. A. Vesna, "Challenges of Financial Risk Management: AI Applications," *Management: Journal of Sustainable Business and Management Solutions in Emerging Economies*, vol. 26, pp. 27-34, 2021.

[12] J. Truby, R. Brown, and A. Dahdal, "Banking on AI: mandating a proactive approach to AI regulation in the financial sector," *Law and Financial Markets Review*, vol. 14, pp. 110-120, 2020.

[13] N. Dhieb, H. Ghazzai, H. Besbes, and Y. Massoud, "A secure ai-driven architecture for automated insurance systems: Fraud detection and risk measurement," *IEEE Access*, vol. 8, pp. 58546-58558, 2020.

[14] C. Soviany, "The benefits of using artificial intelligence in payment fraud detection: A case study," *Journal of Payments Strategy & Systems*, vol. 12, pp. 102-110, 2018.

[15] R. C. Agidi, "Artificial intelligence in Nigeria financial sector," *International Journal of Electronics and Information Engineering*, vol. 11, pp. 40-47, 2019.

[16] M. P. Bach, Ž. Krstić, and S. Seljan, "Big data text mining in the financial sector," in *Expert Systems in Finance*, ed: Routledge, 2019, pp. 80-96.

[17] R. Murugesan and V. Manohar, "AI in Financial Sector—A Driver to Financial Literacy," *Shanlax International Journal of Commerce*, vol. 7, pp. 66-70, 2019.

[18] A. Njegovanović, "Artificial intelligence: Financial trading and neurology of decision," 2018.

[19] V. K. Jain, "How Artificial Intelligence is Transforming the Financial Sector?" *Social Governance, Equity and Justice*, vol. 1, p. 50, 2021.

[20] O. Kaya, J. Schildbach, D. B. AG, and S. Schneider, "Artificial intelligence in banking," *Artificial intelligence*, 2019.

[21] I. Mavlutova and T. Volkova, "Digital transformation of financial sector and challenges for competencies development," in *2019 7th International Conference on Modeling, Development and Strategic Management of Economic System (MDSMES 2019)*, 2019, pp. 161-166.

[22] V. D. Soni, "Role of Artificial Intelligence in Combating Cyber Threats in Banking," *International Engineering Journal for Research & Development*, vol. 4, pp. 7-7, 2019.

[23] H. Pallathadka, E. H. Ramirez-Asis, T. P. Loli-Poma, K. Kaliyaperumal, R. J. M. Ventayen, and M. Naved, "Applications of artificial intelligence in business management, e-commerce and finance," *Materials Today: Proceedings*, 2021.

[24] M. Xie, "Development of artificial intelligence and effects on financial system," in *Journal of Physics: Conference Series*, 2019, p. 032084.

[25] P. Giudici, "Fintech risk management: A research challenge for artificial intelligence in finance," *Frontiers in Artificial Intelligence*, vol. 1, p. 1, 2018.

[26] N. F. Ryman-Tubb, P. Krause, and W. Garn, "How Artificial Intelligence and machine learning research impacts payment card fraud detection: A survey and industry benchmark," *Engineering Applications of Artificial Intelligence*, vol. 76, pp. 130-157, 2018.

[27] A. B. Malali and S. Gopalakrishnan, "Application of Artificial Intelligence and Its Powered Technologies in the Indian Banking and Financial Industry: An Overview," *IOSR Journal of Humanities and Social Science*, vol. 25, pp. 55-60, 2020.

[28] A. M. Mubarek and E. Adah, "Multilayer perceptron neural network technique for fraud detection," in *2017 International Conference on Computer Science and Engineering (UBMK)*, 2017, pp. 383-387.

[29] V.-E. Neagoe, A.-D. Ciotoc, and G.-S. Cucu, "Deep convolutional neural networks versus multilayer perceptron for financial prediction," in *2018 International Conference on Communications (COMM)*, 2018, pp. 201-206.

[30] S. Redhu, S. Srivastava, B. Bansal, and G. Gupta, "Sentiment analysis using text mining: a review," *International Journal on Data Science and Technology*, vol. 4, pp. 49-53, 2018.

[31] E. K. Bognár, "Applying big data technologies in the financial sector—using sentiment analysis to identify correlations in the stock market," *Computational Methods in Social Sciences*, vol. 4, p. 5, 2016.

[32] W. Wagner and I. W. Marsh, "Credit risk transfer and financial sector stability," *Journal of Financial Stability*, vol. 2, pp. 173-193, 2006.

[33] S. Ishii, K. Habermeyer, J. I. Canales-Kriljenko, B. Laurens, J. Leimone, and J. Vadasz, "Capital account liberalization and financial sector stability," 2002.

[34] W. Bank, *Global financial development report 2019/2020: Bank regulation and supervision a decade after the global financial crisis: The World Bank*, 2019.

[35] J. C. Laguna de Paz, "Some implications of the new global digital economy for financial regulation and supervision," *Journal of Banking Regulation*, pp. 1-10, 2022.