International Journal of Advance and Applied Research
www.ijaar.co.in
ISSN – 2347-7075 Impact Factor – 8.141
Peer Reviewed Bi-Monthly
Vol. 6 No. 22 March - April - 2025

Artificial Intelligence and Machine Learning: Pioneering Change in Banking

Mrs. Ashwini J. Shinde
Research Scholar, Department of Computer Science,
PVG's College of Science and Commerce, Pune-09.
Corresponding Author – Mrs. Ashwini J. Shinde
DOI - 10.5281/zenodo.15502042

Abstract:

Financial institutions are organizations that facilitate the flow of money within the economy by providing various financial services. They play a crucial role in managing funds, allowing individuals and businesses in financial transactions. Financial institutions provides security to the personal and financial information of clients. Detects the fraudulent activities that could results in significant loss. Financial institutes have ability to protect customer's assets which ensures the confidence of the customers. It contributing to the overall stability of the financial system. Financial institutions handles huge amount of data. Artificial Intelligence (AI) and Machine Learning (ML) can help such institutes to efficiently process and analyse this data with valuable insights. Automation of routine tasks through AI reduces manual labour, speeds up processes, and lowers operational costs. It analyse historical data to envision future risk which improves the risk appraisement.ML algorithms can efficiently understand the individual customer's preferences and provides personalized financial services as per the customer's interest. AI ensures the rules and regulations in compliance process to reduce the risk of penalties.AI and ML keeps financial institutions competitive by quickly adopting the market conditions and customer needs. AI algorithms can easily understand and interpret transaction patterns to identify and alert customers regarding unusual behaviour by reducing fraud risk.AI is very useful in forecasting the potential cyber threats by analysing current trends and behaviours in data. AI provide better decision making for the financial institutes by evaluating the credit worthiness of the customers. With the help of automated systems continuous monitoring of transactions is possible which plays a vital role in detecting the suspicious activities and provides immediate response.AI and ML significantly improve financial institution's security strength and resilience against threats.

Keywords-Artificial Intelligence, Machine Learning, Expert System, Data Mining, Big Data Chatbots, Adaptive Learning, Data silo, Risk Management, Symbolic reasoning, Customer relation Management.

Introduction:

The latest advances in technology drives significant transformation in banking sector. Among these advancements, AI and ML have emerged as essential tool reconstruct the industry. Traditionally, manual processes, protocols and rules are the crucial methods to conduct the routine operations in bank. However, to improve the customer experience, to enhance the ability to channelize the complicated data, the integration of AI and ML plays a vital role in such banking functions. AI is a technology that enables computers and machines to simulate human learning, comprehension and problem solving, decision making, creativity and autonomy to think and learn like humans. It encompasses various technologies, including natural language processing, computer vision, and

robotics. In contrast, Machine Learning enables computers to learn from data and make predictions or decisions without being explicitly programmed to do so. ML is a branch of AI, It is all about creating and implementing algorithms that facilitates this decision making. The most important advantage of AI and AL is it has potential to improve the risk management. It has ability to analyse the vast data instantly, Identify the fraud indicative patterns, detect risks of credit and enhance the compliance with regularity requirements. One of the most significant benefits of AI and ML in banking is their potential to enhance risk management. By analysing vast amounts of data swiftly, these technologies can identify indicative of fraud patterns. Detect credit risks, and improve compliance with regulatory requirements. Moreover, AI-driven predictive analytics helps to mitigate risks before they appear, ultimately safeguarding their assets and reputation.AI and ML impacting significantly in Customer service area. Bank provide 24/7 support to the customers with the help of chatbots and by providing virtual assistance. AI handles customer's daily enquiries efficiently and executes the routine transactions seamlessly. This improves the customer satisfaction on complicated issues. Personalization, powered by AI, enables banks to launch products and services to meet individual needs, cultivating loyalty and enhancing the overall experience of the customer. AI technologies improves the efficiency by reducing the cost and by increasing the speed of the work. Which helps in optimizing the workforce productivity and strategic and efficient resource allocation. Overall, the integration of AI and ML in the banking.

Background:

Banks began exploring automation for its basic tasks during 1950s with AI, which established a conceptual groundwork which focuses on symbolic reasoning and algorithms, lying the future advancements. Expert System was introduced during 1970s which marks a significant step. Expert system was rule based system which assist in risk assessment and decision making. Expert systems helped to increase accuracy and efficiency in lending process and also automate many banking processes. Data mining techniques was emerged during 1990s when internet provides data generation, which increases the predictive analytics. It helps banks to analyse the customer behaviour, market strategies and potential frauds. During 2000, Banks move from rule based system to adaptive learning systems which includes credit scoring models and enhancement in fraud detection mechanisms. Exploration of big data during 2010 transformed the banking sector.AI and ML allows real-time processing of vast data, allow implementation of chatbots for customer service. During 2026 banks integrated AI into customer relation management. AI assist banks in compliance and regulatory reporting by identifying the potential risks. From 2021 banking operations integrated with natural language processing for risk assessment and enhancement of customer satisfaction. From basic automation to advanced technologies have transformed how banks operate, enhancing efficiency, decision-making, and customer engagement. As AI and ML continue to evolve, their impact on banking will likely expand, paving the way for further innovations and challenges in the sector.

Problem Statement:

Despite the significant advancements in AI and ML technologies, many traditional banks face challenges in implementing these innovations effectively, leading to a disparity in competitive advantage compared to fintech companies. The integration of AI and ML into existing banking infrastructures

presents unique challenges, including data silos, legacy systems, and the need for up skilling employees, hindering the realization of their full potential.

Objectives:

1. Examine how AI and ML technologies have transformed traditional banking operations and services.
2. Highlight specific use cases of AI and ML in banking, such as fraud detection, credit scoring, customer service (chatbots), and risk management.
3. Investigate how AI-powered solutions have changed customer interactions, personalized banking experiences, and improved customer satisfaction.
4. Analyse the role of AI and ML in enhancing compliance with regulations and improving risk assessment methodologies in banking.
5. Study how AI and ML implementations have led to cost savings and operational efficiencies.
6. Explore emerging trends in AI and ML technologies and their potential future impact on the banking sector.

Literature Review:

Search Strategy:

We explored prominent academic research databases like IEEE Xplore, ScienceDirect, ReseachGate and Google Scholar for articles published between 2021 and 2024 to show the effectiveness of AI and ML in banking sector. Plenty of keywords were used to locate the research papers for the present study, such as Artificial Intelligence, Machine Learning, Expert System, Data Mining, Big Data, Chatbots, Adaptive Learning, Risk Management, Data silo, Symbolic reasoning, Customer relation Management. The initial search yielded 25 articles and 10 articles were discarded which didn't support the specific criteria.

Naga Polireddi (2024) [1] highlights importance of Artificial Intelligence (AI) and Machine Learning (ML).AI and ML are playing pivotal roles in the banking sector by enhancing efficiency and security.AI and ML algorithms are employed to detect and prevent fraudulent activities by analysing transaction patterns and identifying anomalies in real-time. These technologies streamline banking processes, leading to improved operational efficiency. Automation of tasks such as data entry and customer service helps reduce costs and errors. AI is transforming credit scoring and risk assessment processes, allowing banks to make more accurate lending decisions by analysing vast amounts of customer data.

Gilad and Tishler's (2023) [2] provides comprehensive insights into how AI technologies are reshaping banking practices. How AI enhances various banking operations, from customer service to fraud detection and risk management. Increased efficiency, improved customer experience, and enhanced decision-making capabilities are highlighted as significant advantages of implementing AI in banking. Addresses challenges such as data privacy concerns, regulatory complexities, and the need for trained personnel to effectively manage AI systems.

Le(2019) [3] and Habib (2024) [4] examine the critical role of AI in revolutionizing banking practices, emphasizing its integration into various banking services like customer support, fraud detection, and personalized banking experiences. The reviews highlight how AI enhances operational efficiency, decreases response times, and improves customer satisfaction, which is crucial in the competitive banking environment. They also identify challenges faced during the adoption of AI, including data privacy concerns, regulatory issues, and the need for significant investment in technology and training. There is a call for future research to

explore the ethical implications of AI in banking and to develop governance frameworks that ensure responsible AI deployment.

Garcia (2023) [5] highlights the increasing adoption of AI technologies in banking operations. It covers applications such as chatbots for customer service, predictive analytics for risk management, and personalized banking. It examines how AI enhances operational efficiency, reduces costs, and improves service delivery in banks. The literature indicates that banks embracing AI have seen significant improvements in financial performance. The study addresses potential challenges, including data privacy concerns, the need for regulatory compliance, and ethical implications surrounding AI decision-making in financial services.

Gonaygunta (2023) [6] The paper emphasizes the importance of integrating Artificial Intelligence (AI) and Machine Learning (ML) into banking to navigate complex challenges. This integration has significant implications for strategic decision-making within banks. Gonaygunta highlights the critical role that the Board of Directors (BoDs) plays in facilitating the adoption of these technologies, ensuring that strategic directions align with the advancements in AI and ML.

Gungor (2020) [7] the paper reviews various AI strategies applied within the banking industry, including how these strategies have adapted to the evolving technological landscape. It focuses on specific service areas in banks where AI is making significant impacts, particularly in enhancing customer service journeys within emerging economies. It highlights the necessity of AI in improving operational efficiencies, risk management, and customer experiences in the banking sector.

Agerfalk (2020) [8] It examines the integration and implications of AI in the banking industry, focusing on the transformational impact AI has on banking operations and customer experiences. It highlights various AI applications within banks, including credit scoring, risk assessment, and customer service automation. It discusses the necessity of adopting AI technologies to remain competitive and address changes in consumer behaviour and market dynamics.

Miller (2022) [9] outlines various applications of AI in banking, such as optimizing customer service interactions, improving fraud detection, and automating processes to enhance operational efficiency. It discusses how AI tools contribute to better customer experiences by personalizing services and improving response times. It highlights potential risks, including ethical concerns, data privacy issues, and the need for regulatory frameworks as banks continue to adopt AI solutions.

Bitskkovskaya 2022 [10] The literature indicates AI's role in improving operational efficiency, enhancing customer experiences, fraud detection, and automating routine tasks in the banking sector. I technologies are being utilized to personalize customer experiences and streamline interactions, contributing to higher customer satisfaction and retention rates. It emphasizes ongoing developments and the need for banks to adapt to rapidly changing technologies while addressing potential risks associated with AI deployment.

Role of AI and ML in Banking Sector:

1. Fraud Detection and Prevention:

AI helps to minimize the financial loss by providing swift response towards the suspicious activities.AI and ML analyse the patterns and behaviour of frauds. It learns from the new data to adopt new model for fraud detection. AI and ML analyse data patterns and customer behaviour to identify security threats quickly and safeguard the customer’s sensitive information.

2. Credit Scoring and Risk Assessment:

AI-driven models assess credit worthiness of customers based on their social media activities, transaction histories, etc. It allows accurate risk assessment and provides wider demographic area for lending.

3. Personalized Customer Experience:

AI analyses the customer's data to offer personalized services which are based on the individual's preferences.AI-driven recommendation systems can suggest relevant financial products and services, while chatbots are used to get immediate assistance, making banking more accessible and user-friendly.

4. Operational Efficiency:

AI automates routine tasks of the banks such as data entry, compliance checks, and transaction processing. Use of AL reduces the human. This, decreases the operational cost helps to allocate all the resources efficiently including human resources.

5. Risk Management and Compliance:

AI continuously monitor the transactions and maintaining compliance with financial regulations. Machine learning models are used to predict potential compliance breaches, which helps to take proactive measures on future risk which may arise.

6. Financial Advisory Services:

Automated investment management service is provided by the AI-powered Robo-advisors. Before providing such services they assess customer's financial goals, risk tolerance, and market conditions to create and manage investment portfolios. AI algorithms make predictions of market trends to enhance investment strategies and portfolio management.

Methodology:

The core components of artificial intelligence (AI) systems, including deep learning, consist of learning and analysis algorithms, computer networks, and data. To facilitate AI learning, high-quality data examples are crucial. Therefore, to develop an AI model with specific attributes, it is essential to establish an appropriate dataset for the learning process. Fig.1 and Fig.2 shows the AI and ML flow.

Data Collection:

Images, text, and audio represent forms of unstructured data that can be gathered during this phase. The initial step in AI development is pre-processing, which focuses on collecting data suitable for the specific application of the AI system. Data collection is a fundamental step in developing any AI or machine learning model. It involves gathering data that will be used to train and validate the model.

Data pre-processing:

This stage involves transforming the collected data to prepare it for input into the machine learning model. During this process, tasks may include addressing missing values, merging existing attributes, adding or removing features, and converting raw data into specified formats. This careful preparation is essential to ensure that the data is clean and suitable for analysis, ultimately enhancing the model's performance. This pre-processing stage involves cleaning, organizing, and transforming the unstructured data into a format that is more manageable for AI algorithms. Techniques like data normalization and noise filtering play a crucial role in improving data quality, ensuring that the AI can derive meaningful insights. Moreover, proper pre-processing helps in identifying essential features within the data, facilitating more effective model training. By establishing a solid foundation during this phase, the overall performance and accuracy of the AI application can be significantly enhanced.

Data Analysis:

During this phase, the collected data is thoroughly examined to prepare it for AI application. This process includes activities such as data mapping, where relationships between different data points are established, and data extraction, which involves exploring and inferring insights from the data. This involves visually and statistically analysing data sets to uncover underlying patterns, trends, and anomalies.

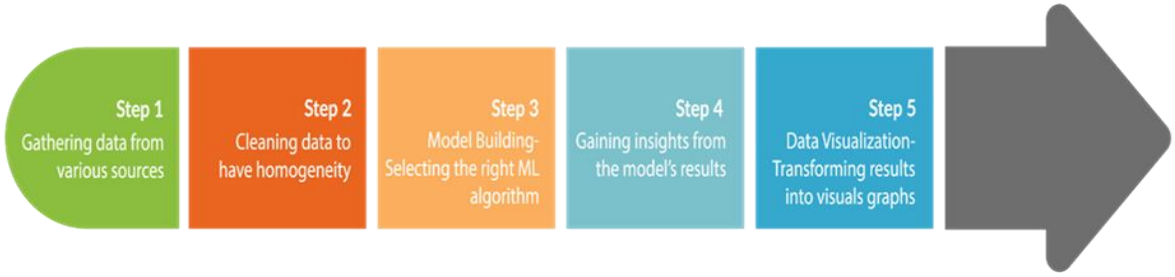


Fig. 1

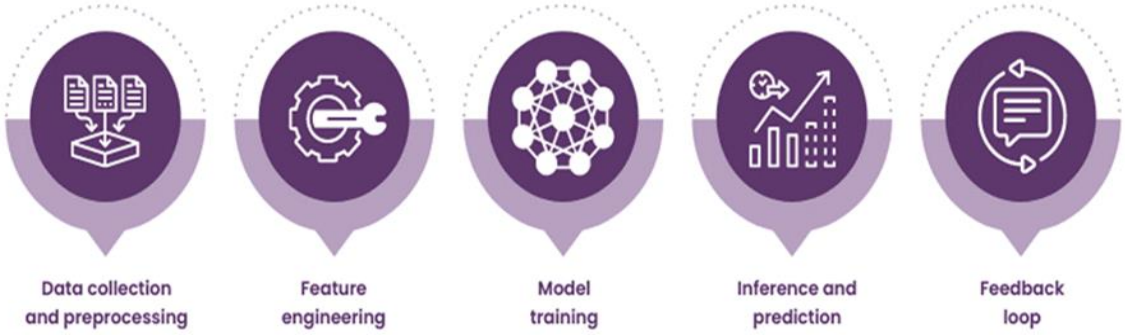
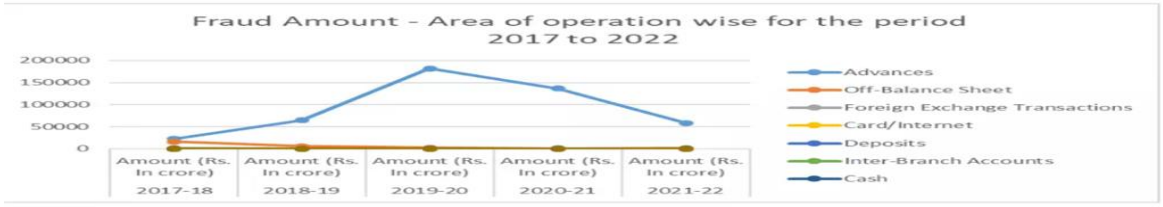


Fig.2

Analysis:

The following charts based on RBI Annual Reports for the period 2017-18 to 2021-22, show the number of frauds, and the quantum of fraud in monetary terms for the period 2017 to 2022 classified based on area of operation, and bank group. It can be noted that credit/debit card and Internet related frauds have risen in the recent times while the amount of such frauds in comparison to the total amount has remained constant unlike the number of frauds in the area of advances which has been volatile but the number of frauds from advances have lowered in the last 3 fiscal years.



The number of frauds has been increasing in private sector banks compared to public sector banks, but the amount of these frauds is lower in the case of private sector banks during the period 2021-22. Integrating technology into banking operations without relevant understanding and analysis of the information gathered through them over time is a waste of that resource. Financial institutions should ideally build or integrate advanced fraud prediction models to proactively detect irregularities and weed out suspicious applicants. Proper governance, non-political interference, effective internal and external auditing, authentication protocols, transaction monitoring, raising fraud awareness.

Conclusion:

The integration of Artificial Intelligence (AI) and Machine Learning (ML) in the banking sector has transformed the landscape of financial services, enhancing efficiency, customer experience, and risk management. These technologies enable banks to analyse vast amounts of data, offering personalized services and improving decision-making processes. However, challenges such as data privacy, ethical considerations, and the need for regulatory compliance must be addressed to harness their full potential. As the banking industry continues to evolve, embracing AI and ML will be crucial for remaining competitive and driving innovation, ultimately paving the way for a more secure and customer-centric financial environment.

Future Scope:

Research opportunities in developing AI-driven systems for tailored financial products and services based on individual customer behaviours and preferences. Researching the intersection of AI, ML, and block chain to enhance security, transparency, and efficiency in banking transactions. Examining ethical implications and governance frameworks for AI and ML, ensuring responsible use of technology in banking.

References:

1. Kumar, A., & Singh, H. (2020). Role of Artificial Intelligence in Banking Industry: A Review. International Journal of Management Studies.
2. Jagtap, S. (2021). Machine Learning in Banking: A Review of Applications and Challenges. Journal of Banking & Finance.
3. He, D., & Xu, C. (2020). The Impact of Artificial Intelligence on the Banking Industry. Journal of Financial Research.
4. Gupta, M., & Singh, R. (2019). AI-Based Credit Scoring Models in Banking: A Review. International Journal of Information Management.
5. Chawla, R., & Bhattacharyya, S. (2021). The Future of Banking with Artificial Intelligence. Journal of Financial Services Marketing.
6. Zhang, Y. (2022). AI and Machine Learning for Fraud Detection in Banking: A Survey. Journal of Financial Crime.
7. Turner, J. (2020). Automating Compliance with Machine Learning in Banking. Regulatory Compliance Journal.
8. Ghafur, A., & El-Zoghbi, M. (2021). Predictive Analytics in Banking: A Machine Learning Approach. International Journal of Bank Marketing.
9. Brahma, S., & Siva, R. (2020). Chatbots in Banking: Enhancing Customer Experience. Journal of Service Management.
10. Mazzocchi, A. (2019). AI Ethics in Finance: A Study of Banks' Practices.

Journal of Financial Regulation and Compliance.
11. Aydin, M. (2022). The Role of Machine Learning in Automated Financial Decision Making. Finance Research Letters.
12. Bell, D., & Hesketh, R. (2020). Enhancing Risk Management with AI and Machine Learning in Banking. Risk Management Journal.
13. Mustapha, S. A. (2021). Blockchain Technology: Opportunities in Banking and Finance. International Journal of Financial Studies.
14. Haseeb, M. (2020). The Future of AI in Banking: Trends and Opportunities. Technology in Society.
15. Roy, A. (2021). The Application of Deep Learning in Financial Services. Journal of Machine Learning Research.
16. Wang, Y., & John, R. (2021). Artificial Intelligence and its Impact on Customer Loyalty in Banking. Journal of Retailing and Consumer Services.
17. Liam, F. (2020). Risk Assessment Models using ML in the Banking Sector. Journal of Risk Finance.
18. Nair, R. (2022). The Integration of AI and Emotional Intelligence in Banking. Frontiers in Psychology.
19. Lee, K. (2020). Machine Learning for Credit Risk Modeling: A Review. Journal of Credit Risk.
20. Sarma, S. (2021). AI in Investment Banking: Transforming Investment Strategies. International Journal of Banking, Accounting and Finance.
21. Alluri, H. (2020). Analyzing Customer Behavior with AI in Banking. International Journal of Bank Marketing.
22. Dey, A. (2021). A Survey of Applications of AI in Banking Operations. Journal of Banking and Financial Technology.
23. Borders, J. (2020). The Role of AI in Transforming Payment Systems. Payments Journal.
24. Patel, V. (2021). Machine Learning Techniques for Customer Retention in Banking. Journal of Business Research.
25. Zhao, X. (2022). Future Trends of AI and ML in Banking: A Scoping Review. Journal of Banking & Finance.