

Artificial Intelligence and Machine Learning in Banking Sector-An Overview

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Abstract- The banking sector has been transformed from people centric to customer centric. By adopting a holistic approach bank are trying to meet customer demands and expectations. Here the Artificial intelligence and machine learning technologies are acting as savior. They are useful in processing large volume of data and anticipate the current market trends. These technologies are also useful for credit management, understanding behavior and pattern of customers, validating customers creditworthiness thus reducing the chances of any bank default, marketing, risk-management, process automation, providing information on banks solvency, trading activities, regulatory compliance etc. Therefore, these technologies are playing a very crucial role in banking sector. The paper analyzes role of AI and ML in banking sector by focusing on their advantages as well as challenges in implementing these technologies.

Keywords: Application of Artificial Intelligence, Machine Learning, Banking System, Technology.

I. INTRODUCTION

Artificial intelligence is basically a simulation of human intelligence process by machines. It performs functions such as reasoning, learning, interacting, problem solving and innovation.

Machine learning is a method used to solve the issues that optimizes through previous experiences with no human involvement. They are based on mathematics and statistical theory.

As per research conducted by TCS-Investment in AI helped the banking sector as there was significant reduction in production cost approx. 13%. The banking executives also experienced an average increase in revenue (17%) where AI was implemented.

Under JP Morgan's Machine learning system was used to save almost 36000 hours of lawyer and credit processing work every financial year. Further modification done from statistical regression to ML for doing credit analysis work proved useful in increasing the mortgage collection by 30%.

The survey undertaken to study AI and ML across geographies for 34 major banks (India, Africa, Singapore, US, EU, Australia) revealed that out of 34 banks 27 banks have implemented AI for doing front office desk functions, chatbots, virtual assistants,

reduce fraud, tax reporting and automate regulatory compliance.

Objectives:

1. The specific objective of the paper is to understand the role of Artificial Intelligence and Machine Learning technologies in enhancing the service efficiency in banking sector.
2. To discuss the application of AI and ML in Indian Banking sector.
3. 3.To highlight the challenges the banking sector faces in operation.

II. RESEARCH METHODOLOGY

The research methodology adopted is descriptive in nature. The author has used secondary method for data collection.

III. LITERATURE REVIEW

According to John McCarthy, the father of artificial intelligence (A.I.), precisely describes artificial intelligence as "it is the science and engineering of creating intelligent machines", focusing on building intellectual computer programs (Kumar & Chandrakala, 2016).

Implementation of machine learning in the banking sector helps in quickly adapting to the changes in the competitive market. With ML banks are analysing the

historical data as well as the client's behaviour. This helps banks to understand and predict the purchasing, investment patterns of their clients and for effective decision making.

As per McKinsey study it was revealed that around forty percent of the large banks were less productive than the digital ones. The banking startups and many of the fintech companies were pioneer in AI implementation. This increases the necessity for the traditional banks to speed up and adopt the new technology. Successfully implementing and positioning generative AI solutions, along with effective data management, is required to achieve the goal.

While RBI firmly boost AI and Machine Learning (ML) in banking for better efficiency and fraud detection, however mandates banks over strict governance to mitigate systemic and consumer risks. The guidelines cover having control human oversight, board-approved risk frameworks on all the functional and operational models, and customer-facing disclosures.

IV. AI AND ML IN BANKING SECTOR

Artificial intelligence, financial technology and financial inclusion are all working together. These are acting as most important pillars in strengthening the financial sector by reducing the gap between what financial institutions offer and customer expectations.

AI and ML is useful in providing financial services, automating repetitive front office services, answering customer queries, minimizing operational cost.

McKinsey's Global AI survey report summarizes the preferred AI technologies in banking/financial institutions are used such as, robots in automation (36%), followed by virtual assistants or chatbots for resolving any repetitive tasks (32%), availing customer services, machine learning techniques (25%) to protect against any fraud/scams and help in mitigating the associated risk.

For instance, 32-34 public and private banks utilize AI and ML. As per research 90% of Indian BFSI firms have AI strategies, with 60-70% actively using these technologies for fraud detection, credit underwriting, and 24/7 conversational support.

As per the National Business Research Institute and Narrative Science report 2020 more than thirty two percent of banks are using AI for predictive analytics, speech recognition so as to enhance their service efficiency thereby grabbing competitive edge over the market.

The Reserve Bank of India in its supervisory process are using AI and ML and further the benefits of using these advanced analytics are being adopted in the department of supervision in central bank. The department through linear and machine learnt models (on-site inspection and off-site monitoring) supervisory examinations are exercised at all select Indian financial institutions such as NBFCs, urban cooperative banks, payment banks, small finance banks, local area banks and even for credit information companies.

Therefore, using AI and ML in banking and financial sector helps in reducing the operational cost, improving banking/branch efficiency and accelerate innovations in the process.

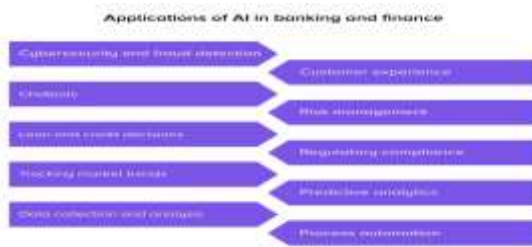
Benefits of artificial intelligence in banking sector:

1. Maintaining customer profile, understanding and segmenting their requirements.
2. Customer retaining target specific strategies
3. Understanding the spending pattern of customers
4. Working on product selling and cross selling strategies
5. Focus on maintaining existing customers
6. Working on upscaling the business performance
7. Robust monitoring on regulatory compliance
8. Adopting risk management strategies
9. Enhancing the cybersecurity and financial crime management
10. Increasing operational efficiency.

Banks' AI initiatives



AI -Applications used in Banking and Finance Sector.



V. EXERCISING CYBER PROTECTION AND DETECTION OF FRAUD

With numerous digital transactions taking place every day (bill pay facility, mobile banking, withdrawal etc) done through several applications /online services, use of AI helps banks in identifying the fraudulent operations, effective tracking of every transaction, thereby minimizing the risks and better security for online operations. AI and ML help in storing, processing and analysing large volume of customer data.

For instance, during 2019 – Twentynine percent of cyber-attacks were experienced by the banking sector. But with effective AI monitoring the banks were proactive in tackling the cyber-attacks and immediate actions were taken so as to protect customers, employees and internal system data.

Present Status of Banking AI Cybersecurity:

- **Proactive Défense Mandates:** Regulatory bodies like the Reserve Bank of India (RBI) and SEBI have mandated financial institutions to implement stricter AI governance frameworks and assess vulnerabilities that frontier AI models could exploit.
- **Continuous AI Monitoring:** Over 80% of banks are utilizing AI for operational risk management, deploying Network Detection and Response

(NDR) systems to monitor traffic and instantly quarantine suspicious activity.

- **Shadow AI Policies:** Following internal data leaks from shadow AI usage, banks have blocked unapproved AI domains and tightened employee access to safeguard internal data.
- **Fraud Prevention:** Financial institutions are deploying real-time, AI-driven anti-money laundering (AML) and compliance platforms to minimize false alarms and proactively lock suspicious or "mule" accounts.

Chatbots: The chatbot service is available for the customers round the clock. The service is beneficial in understanding the customer behaviour pattern so as to offer customised products and services. With the support of AI- chatbots and virtual assistants offer technical and financial advisory services to customers.

Customer Sentiment Analysis: AI in combination with big data analysis and machine learning tools are used to organize customer information, analyse financial transaction. Monitoring financial transactions is done with this technology.

Providing credit facility: AI is providing banks with all the customer related information which helps banks in assessing the creditworthiness of the customers. This helps banks official in taking better credit decisions.

Market trends and patterns: Evaluating stock performance, analysing various stocks, understanding future trends with respect to market growth and volume is done using AI and ML technology. Advanced machine learning techniques are used in understanding the market sentiments as well as in analysing large volume of stock data.

Better customer facility: The banking sector has undergone tremendous changes after the inclusion of Artificial Intelligence and Machine learning tools in their day-to-day operations.

These technologies have increased the customer as well as banking officials' convenience thereby reducing the banking operations time. Banking online portals are used for promoting various assets

as well as loan products. Such as personal loan, auto loan, home loan, amortization of loans, loan disbursement, credit and debit card etc.

Risk Management and Regulatory Compliance

The banking sector is a regulated sector under RBI and Government. The sector is prone to frequent amendments in the compliance regulations. Hence the banking system needs to be restructured on a timely basis. AI and ML technologies are proved to be useful in storing the data as well as in automating the process so as to have faster transactions.

Predictive Analytics: The analysis includes study of business specific patterns and establishing correlations with data. Predictive analysis using AI and ML tools helps in understanding the business activities, exploring cross selling opportunities to increase the sales of their product.

Controlling Risk: As per BASEL committee banks operational risk is the risk of loss due to inadequate or failed internal process, people and system or external events. Therefore, with AI system in place banks are able to control operational risk by analysing current and future plans, reviewing past and current performances thereby minimizing errors in operations. Since AI uses codes as an indication to authenticate business transactions thus any kind of fraud or money laundering activities are minimized.

V. BACK OFFICE USE CASES OF AI & ML

Intelligent Automation: With bigdata and machine learning tools process automation is getting easier as manual work is being replaced with advanced technology. Error -prone task are automated leading to efficient high-speed workflows. For example, in KYC document processing is automated, transaction reconciliation, fraud detection, regulatory compliance.

Intelligent process automation helps in controlling the everyday operating cost as well as enhancing the customer experience. At the same time, it allows the banks to scale their business operations. Paperwork automation, use of chatbots in resolving the customer queries, employee training gamification etc. Machine learning models alone match, verify,

and reconcile complex ledger entries, settlement statements, and cross-border transactions across disparate systems.

Assimilation of various apps and digital assistants continues to improve short- and long-term operational activities such as automation in bill payments or tax filings, investments etc. For better customer service banks are using self-help virtual reality systems. For complete and accurate KYC reports, rigorous due diligence AI and ML bring great level of transparency which currently take too many labour hours.

Integrated Command & Control Systems: As the banking sector are dealing with multiple parties globally AI algorithms are proving highly beneficial in screening customer data against the global sanctions list if any, information on politically exposed person databases etc. The analysis works well for making better informed decisions. Use of data engineering, machine learning algorithms altogether refers to Integrated command and control centre.

Also, ML is able to detect transaction anomalies that traditional rule-based software misses, resolving exceptions without requiring manual intervention.

VI. TRADING AND PORTFOLIO MANAGEMENT

Wealth and Portfolio Management: AI integration can help in identifying the potential investors based on spending pattern and monthly income. The data engineering can identify the market trends and works on selection of funds for client's portfolio. Thus win- win situation for both.

Algorithmic Trading: The trading platforms are more streamlined, efficient and accurate than the actual live traders.

Regulatory compliance & Supervision

Cybersecurity and Anti Money Laundering: For enhancing cybersecurity AI assists banks in identifying the limitations in system and making it more secure. Application of AI and ML in enhances

cybersecurity and money laundering operations. Identifying suspicious or unusual transactions in money laundering activities is crucial in the present world.

These tools monitor numerous transactions and customer communications in real time, allowing banks to investigate irregularities that signal scams or account manipulation. Recognizing possible fraud patterns, working on emergent threats, the model excellently reduces false transactions and safeguards customer accounts and assets.

AI-Powered Fraud Detection: ML algorithms have the capacity to detect fraud by going through millions of data points. It improves the quality of real-time approvals while reducing the number of false rejections. If there is any suspicious behaviour from certain bank accounts, it will identify them in real-time instead of detecting them after the crime.

ML-Driven Underwriting Processes: Machine learning underwriting process is a structured process undertaken to evaluate customer data. The credit worthiness of the customers is analysed using big data and machine learning tools. This provision is useful to process loans, with respect to varied number of customers. With respect to corporate lending these technologies are working for simplifying the lending process as well as for analysing the market trends, understanding various risk associated with lending, and safeguarding the transactions.

Therefore, for adopting these technologies the banking IT infrastructure should be equipped with qualified technical expertise.

Personalized Banking: Personalization of banking services is need of the hour. Many banks are already providing services /recommendations suitable to individuals financial goals, savings and investment plans, insurance portfolios etc. With Artificial Intelligence and machine learning tools large number of banks must use predictive analytics to understand customer's financial requirements.

Indian Bank-Wise Data & Use Cases

- **State of Bank of India (SBI):** Uses self-learning AI systems that monitor transactions using anomaly detection. AI-enabled systems flagged nearly 3,000 fraud attempts in recent periods, reducing false positives by over 30%. Its conversational AI chatbot, "SIA," processes over a million customer queries daily. The results – with AI the banks have reduced loan processing time by 60% and improved its risk assessment accuracy by 40%.
- **ICICI Bank:** Deploys machine learning algorithms to scan for transaction anomalies in real-time to detect fraud patterns. The bank has automated over 1,200 internal processes with AI, resulting in a 60% reduction in manual errors. Its iPal chatbot integrates with Amazon Alexa and Google Assistant for voice banking. The result - with AI bank have reduced operation cost by 25% and customer satisfaction scores have improved by over 15% as per their annual reports.
- **HDFC Bank:** Uses the AI-powered chatbot "Eva". Eva successfully addressed over 2.7 million queries from more than 530,000 users in its early deployment phases, significantly reducing human workload. Thus, with AI the banks have reduced customer query resolution time by over 50% and cross-selling efficiency is also improved by 30%.
- **Axis Bank:** Utilizes AI and Natural Language Processing (NLP) apps for "Conversational Banking" to help consumers process financial and non-financial transactions. It also uses AI to analyse alternative data (digital footprints, utility bills) to provide loans to first-time borrowers. The loan approval accuracy is improved by over 35% and customer churn by more than 20%.
- **Bank of Baroda:** The bank adopted automated KYC verification system, customer segmentation using AI for efficient service delivery, AI based loan processing system. Automated SME lending platform introduced. Also, AI based financial planning tools. Controlling fraud through customer behaviour analysis. The results are loan processing time is reduced by over 40% and cross selling is improved by over 25%.

- **Reserve Bank of India (RBI):** Utilizes AI tools like DPIP to detect financial fraud in real time across the national banking network.

As AI and ML are proving very efficient in taking care of routine as well as critical task, however we cannot ignore the challenges in implementing these technological advances.

VII. CHALLENGES IN ADOPTING AI & ML IN BANKING

Data security, Digitization and Cyberthreats:

1. The banking industry with its digitisation of services in the form of NEFT, RTGS, online banking, cyberthreats are also increasing. Large amount of customer data is available on the internet as telecom, banking and IT services are coming together. Therefore, with AI and ML tools customers data security is of primary importance.
2. By integrating AI into banking systems without replacing them entirely increases maintenance costs and creates system vulnerabilities.
3. Banks need to protect their system effectively as if a bank's AI system is penetrated or corrupted, attackers could gain access to extensive customers personal information, potentially undermining financial integrity and customer trust.
4. It is equally important to have skilled human resource to operate these technologies. In case of tier two or tier three cities the banks are not fully updated and are still following the traditional banking practices. Hence there is requirement of complete transformation of these banking units.
5. With digitization of banking services banks are coming under the domain of privacy of regulation policies. Hence it is very important for the banking sector taking AI and ML services to regularly upgrade the system and follow the regulatory compliance.
6. Although the benefits are many still AI will have a serious impact on the labour-intensive market. As per the report published by Accenture, AI, robotics and big data will increase the labour productivity in almost 12 developed economies by 40 percent by 2035 resulting in major job loss.

VIII. CONCLUSION

The impact of artificial intelligence and machine learning is very thoughtful and transformative in changing the whole banking sector. The research paper has covered many aspects of how AI and ML application is are redesigning the traditional banking operations on a daily basis.

The paper covers the opportunity as well as the future challenges while adopting the advanced tools. RBI encourages AI, ML in financial institution while keeping strong corporate governance in mind.

The major Indian banks have done a heavy investment in AI technologies for digital transformation. The main areas include enhancing customer services, faster delivery, real time monitoring, controlling risk, fraud, automating various routine process, predictive analytics, intelligent decision making and providing better personalized banking services to customers.

With technological advancements accelerating at a higher speed banks are also investing in research and developments, training employees, preventing cyber-attacks, maintaining ethical standards, and safeguarding consumer rights.

In conclusion, implementing AI and ML in banking sector is very dynamic as the technological advancements are taking place every day. For efficient execution banking sector needs to have better coordination between the industry stakeholders, regulators and society. The role of policy makers and regulators (RBI) is very important while establishing the frameworks and addressing the potential AI challenges in years to come.

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