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COGNITIVE BANKING: THE ROLE OF AI IN RESHAPING BANKING LANDSCAPE

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ABSTRACT

This research paper aims to explore the growing influence of Artificial Intelligence (AI) in the banking sector, examining its implementation across various public and private banks. To identify the information used in banking and financial services, the data is collected from secondary sources based on literature review. The study explores various AI applications, including fraud detection, customer service automation, personalized banking, and data-driven decision-making. AI also helps with customer support via chatbots, security through biometrics, and offering tailored financial advice. By analyzing industry reports, academic research, and case studies, the paper will explore both the advantages and challenges of AI implementation in banking, as well as the future impact of this technology on the industry. This will explain how AI is helping in enhancing efficiency, improving customer satisfaction, and better risk management, while also addressing challenges like data privacy concerns, security risks, and the potential for job displacement. The findings offer valuable insights into the current state of AI adoption in banking and suggest strategies for overcoming the barriers to successful implementation, ultimately shaping the future of AI in the financial industry.

Keywords: *Artificial Intelligence, Virtual Assistant, Chatbots, Banking System, Machine Learning.*

Introduction

Human beings possess natural intelligence, which is defined as the ability to perceive, analyze, evaluate, and reason in order to reach conclusions or solve problems. This capacity also enables individuals to learn from experience, grow, and advance over time. Artificial intelligence [AI] and Machine learning are terms used to describe comparable features displayed by machines. AI refers to a machine's ability to mimic human thought processes, enabling it to make logical decisions and select the most effective option from a range of possibilities in order to achieve a specific goal.

In the digital age, Artificial Intelligence (AI) has emerged as a transformative force in numerous industries, and the banking sector is no exception. Traditionally characterized by in-person interactions and manual processes, the banking industry is experiencing a profound shift due to the integration of AI technologies. As financial institutions increasingly adopt AI tools, they are discovering new opportunities to enhance operational efficiency, deliver personalized customer experiences, and mitigate potential risks. With applications spanning fraud detection, credit assessment, customer service, and financial forecasting, AI has quickly become an indispensable element in contemporary banking operations.

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AI's introduction to banking services began in the 1990s, as financial institutions started to explore automation and data processing to enhance efficiency. Initially, AI was used for basic tasks such as automating transactions and managing databases. By the 2000s, the rise of big data and machine learning enabled banks to use AI for more complex functions, such as fraud detection and customer service through chatbots. In the following years, AI-driven technologies, like predictive analytics and personalized marketing, became more common, allowing banks to offer tailored services and improve decision-making. Today, AI plays a vital role in banking, helping streamline operations, strengthen security, and elevate customer experiences.

AI In Banking Services

AI is playing a crucial role in modernizing and digitizing traditional banking systems, particularly in the context of Indian banking. It involves leveraging computer capabilities to acquire and apply knowledge without requiring human intervention. The advantages of these disruptive technologies for the financial sector are clear and measurable, resulting in enhanced efficiency and potential revenue growth. While AI adoption in banking has been gradual, it has been successfully implemented in smart applications like real-time fraud detection in online banking and improving the KYC process. These applications are helping to reduce costs, increase productivity, and improve operational performance within the banking industry. The automation of repetitive tasks through AI systems is also decreasing the demand for low-skilled workers.

AI includes both machine learning and natural language processing, and these technologies can be applied within the banking sector. Machine learning is a data analysis technique that automates the creation of analytical models. It enables computers to modify their algorithms or parameters as they process new data, eliminating the need for manual reprogramming. Natural language processing (NLP) involves the ability of computers to understand and generate human communication, whether written or spoken, as input that triggers specific computer actions. Natural language generation (NLG) involves producing human-like written content, capable of summarizing complex data, such as generating speech or creating detailed reports on financial performance.

AI is Being Utilized in a Range of Applications within Banking Services

- **Fraud Detection and Prevention:** AI algorithms constantly monitor transaction data to identify any unusual patterns or behaviours that could indicate fraud. Machine learning models are capable of detecting anomalies in real time, flagging potentially fraudulent activities, and assisting banks in preventing losses while boosting security.
- **Customer Support and Chatbots:** AI chatbots and virtual assistants are gaining popularity for managing customer service inquiries. These systems can handle a range of tasks, from simple account questions to more intricate banking needs, providing 24/7 support and enhancing efficiency by minimizing the reliance on human agents.
- **Personalized Banking Services:** AI analyzes customer data, including spending patterns and financial goals, to deliver personalized financial advice. This can involve customized recommendations for savings, investments, or debt management. AI-powered robo-advisors offer automated investment guidance tailored to clients' risk profiles and financial objectives.
- **Credit Scoring and Risk Assessment:** AI improves the accuracy of credit scoring by considering not only traditional financial data but also alternative data sources, such as social behavior and transaction history, to better assess a customer's creditworthiness. Furthermore, AI assists banks in evaluating and managing risks by forecasting market trends, loan defaults, and potential financial disruptions.
- **Robotic Process Automation (RPA):** AI is increasingly being used in Robotic Process Automation (RPA) to handle repetitive, time-consuming tasks like processing documents, verifying identities, and reconciling accounts. By automating these processes, banks reduce manual errors, speed up operations, and lower costs, while freeing up employees to focus on higher-level tasks that require human expertise.
- **Voice and Biometric Authentication:** AI-driven voice recognition and biometric systems enhance security and convenience for customers. These technologies allow customers to access their accounts, make transactions, and authenticate their identities using voice commands or biometric identifiers like fingerprints or facial recognition. This adds an extra layer of security while offering a simple and efficient method for customers to interact with their bank.

- **Enhanced Customer Experience:** AI helps banks create a more personalized customer experience by analyzing data from various touchpoints, such as mobile apps, online platforms, and in-person interactions. With this insight, banks can predict customer needs and deliver tailored services, such as personalized product recommendations or faster support, ultimately enhancing customer satisfaction.
- **Market and Investment Insights:** AI supports banks in analyzing market data and trends to help inform investment strategies. By processing vast amounts of information, including historical market data, news reports, and financial documents, AI identifies patterns and potential investment opportunities. It also predicts market movements, helping banks adjust their investment portfolios and strategies to maximize returns and minimize risk.
- **Predictive Analytics for Financial Planning:** AI-driven predictive analytics models are used to help banks forecast future financial trends, customer behavior, and economic shifts. By analyzing data such as transaction patterns, seasonal spending habits, and historical performance, AI can predict trends like increased demand for specific services or products. This enables banks to make proactive decisions and allocate resources effectively, ensuring they meet future customer needs and optimize their operations.
- **Loan Approval Automation:** AI accelerates the loan approval process by automating various tasks such as credit checks, document verification, and risk assessment. AI systems analyze a customer's financial history and behavior to quickly assess loan applications, enabling faster decisions. These AI models can evaluate the likelihood of repayment, ensuring that banks lend responsibly and efficiently.

Learning Objective

- To examine the core concepts of artificial intelligence and its integration within the banking sector.
- To investigate how different banks apply AI technologies in various aspects of their operations.
- To examine the challenges related to the adoption of AI in the banking sector.
- To predict future developments in AI technologies and their potential role in reshaping the banking industry in the coming years.

Literature Review

(Rathnakar Achary, 2021): Artificial Intelligence Transforming India Banking sector. This research paper explores AI application and their scope of implementation in financial sector and seeks to map the AI implementation and its present state in the Banking and financial sectors in India.

Dr. S. Umamaheshwari, Dr. A. Valarmathi, M. Raja Lakshmi(2023): Role of Artificial Intelligence in The Banking Sector . This paper emphasizes the impact of AI implementation at the banking zone procedures. This also studies about different AI tools in different Banks of India.

Krutika Sawant, Harshvardhan Soni, Parthraj Maharaul, Saurabh Agarwal(july 2023): A study of AI in Banking System. This research paper explores the current state of AI in banking and financial services as well as its potential impact on the industry as the banking and financial services sector has been major operational change as a result of the growing usage of AI.

Sindhu J(2019): In this study, AI adoption in five commercial banks- SBI, Axis, ICICI, HDFC and HSBC- is discussed with reference to cost-benefit analysis. This also explores how they use AI in their banking services and their different AI tools.

Different AI Tools Used by Different Banks

- **State Bank of India– SIA (SBI Intelligent Assistant)**

State bank of India is one of the largest public sector banking services provider in India. To deliver effective banking services, SBI introduced **SIA** (SBI Intelligent Assistant), an AI-based virtual assistant designed to address customer queries around the clock. By utilizing **NLP** and **ML**, SIA can understand and respond to customer questions, ranging from transaction details to product information. By automating common tasks, SIA reduces wait times for customers and allows them to access banking services at any time of the day. SIA is designed to handle around 10,000 inquiries every second, which adds up to about 864 million queries each day. This is about 25% of the number of queries Google processes daily, showing just how powerful and capable SIA's system is.

- **HDFC Bank-EVA (Electronic Virtual Assistant)**

HDFC, headquartered in Mumbai, is another banking and financial services company that utilizes AI. HDFC's intelligent chatbot, Eva, launched on march 2017, collaborates with Google Assistant across millions of Android devices, helping customers by answering their queries and delivering enhanced services. According to HDFC Bank, Eva is India's first AI-powered banking chatbot, capable of instantly responding to millions of customer queries across various platforms. Eva can gather information from thousands of sources and deliver answers in straightforward language in under 0.4 seconds. HDFC Bank's AI chatbot, Eva, has greatly improved customer service since it launched in March 2017. By the middle of 2017, Eva had interacted with over 530,000 users, completed 1.2 million conversations, and answered 2.7 million queries.By mid-2017, Eva had handled more than 16 million conversations with an accuracy rate of over 90%.In 2021, Eva was added to the Digital Seva Portal to help Village Level Entrepreneurs (VLEs) and their customers access banking services more easily.These achievements highlight Eva's importance in improving customer interaction and efficiency at HDFC Bank.

- **ICICI Bank- iPal**

ICICI Bank, a leading private sector bank, operates across over 200 business processes in various functions within the company. With this, the bank became the first in the country to implement an AI system on a large scale across various processes. ICICI Bank launched its AI-powered chatbot, **iPal**, in **2017**. Since its launch, **iPal** has greatly improved customer service. By mid-2017, it had already interacted with over 3.1 million customers and responded to 6 million queries, maintaining an accuracy rate of about 90%. In 2020, ICICI Bank integrated iPal with Amazon Alexa and Google Assistant, allowing customers to carry out banking tasks using voice commands. The report states that ICICI Bank has scaled its RPA initiative to more than 750 software robots, handling almost 2 million transactions per day, which represents 20% of the bank's overall transaction volume.

- **AXIS Bank**

Axis Bank has two distinct chatbots: **Axis Aha!** and **AXAA**.

Axis Bank, in partnership with Active.Ai, introduced Axis Aha! in early 2018, and the platform has since seen a notable rise in usage, with over 10 million customers engaging with the conversational AI on their mobile banking app. It is a text-based AI chatbot that is integrated into their mobile banking app and various other digital platforms. In 2023, Axis Bank enhanced its AI capabilities by launching a GenAI-based chatbot for around 60,000 users across its branches. This initiative was designed to boost customer service efficiency and offer more personalized banking experiences. Axis Aha offers a range of services such as credit card bill payment, fund transfer, bill payments, account balance inquiries, cheque book request.

AXAA is an AI-driven multilingual voice assistant developed by Axis Bank, launched in July 2020 in partnership with Vernacular.ai. This advanced voice assistant is designed to process customer queries and requests using natural language conversations in English, Hindi, and Hinglish. AXAA helps customers navigate through the IVR system and addresses their queries and requests, often eliminating the need for human intervention. Customers can complete a range of banking tasks, including checking account balances, requesting mini-statements, and paying bills, simply by using voice commands.

- **Bank of Baroda**

Bank of Baroda launched ADI(Assisted digital interaction) in 2024, an AI-powered chatbot designed to enhance digital customer service. Acting as a virtual relationship manager, ADI provides 24/7 support through audio, video, and chat interactions, and offers a seamless banking experience with its multilingual features. Along with ADI, Bank of Baroda has introduced a GenAI-powered knowledge management platform called GyanSahay.AI for its employees. This platform, which is trained on the bank's product policies and procedures, delivers instant and accurate responses, helping employees address customer queries more effectively.

- **Andhra Bank**

Andhra Bank, a medium-sized public sector bank in India, merged with Union Bank of India in April 2020. Given its extensive network of branches and satellite offices nationwide, the bank has incorporated advanced technology to improve its services. On July 15, 2019, Andhra Bank launched ABHi, an AI-driven virtual assistant, in partnership with Floatbot, to address customer queries immediately and effectively. By July 2019, ABHi had been integrated with Andhra Bank's core banking systems to digitally interact with and automate customer support for its more than 50 million customers.

- **Kotak Mahindra Bank**

In 2018, Kotak Mahindra bank has introduced Keya, an AI-powered chatbot aimed at improving customer service and optimizing banking operations. Leveraging advanced AI and Natural Language Processing technologies, Keya understands customer queries and quickly retrieves relevant information from its knowledge base in milliseconds. In 2019, bank launched Keya 2.0 voicebot, an enhanced version of its AI-powered voicebot, designed to offer a more tailored and efficient banking experience. By 2021, Keya was handling more than 3.5 million queries each month, achieving a 93% AI accuracy rate, and supporting over 1 million users on a monthly basis.

Barriers to AI Adoption in India

- **Lack of Skilled Workforce:** There is a shortage of skilled data scientists capable of working with AI in India. While the demand for AI experts continues to rise, there aren't enough qualified data scientists, machine learning specialists, and AI engineers to fulfill the growing industry requirements. In addition to the lack of qualified professionals, banks also struggle to find personnel who are well-versed in the latest technologies and software. To tackle this issue, the financial services sector should partner with Indian institutions to hire qualified data scientists and create in-house training programs that provide staff with the expertise needed to effectively integrate AI into banking operations. Universities around the world, including those in the US and UK, are adapting to the AI-driven changes in the banking sector by offering undergraduate and master's programs focused on fintech.
- **Concerns Over Data Privacy and Security:** AI systems require vast amounts of training data, which is collected by tracking consumer behavior both online and offline. This data is stored, combined with other information, and used to create large datasets that may include transaction details, emails, videos, search queries, health records, and social media activity. The lack of robust data protection laws makes users susceptible to the misuse of their personal information, thereby diminishing trust in AI systems. Between 2016 and 2018, India ranked second in the world for cyberattacks, highlighting the importance of using language that resonates with consumers when communicating with them.
- **Lack of Clear Regulations and Ethical Guidelines:** A major challenge in adopting AI is the lack of comprehensive policies and ethical guidelines for its use. India currently does not have a unified framework to regulate AI technologies, leading to confusion and delays in implementation. The absence of clear regulations on important issues like algorithmic transparency, accountability, and ethical deployment makes companies and organizations reluctant to fully embrace AI. Furthermore, without a dedicated regulatory body, ensuring the ethical use of AI becomes even more difficult.
- **Resistance from Organizations and Employees:** Resistance to AI adoption exists both culturally and organizationally, mainly due to concerns about job loss from automation. Workers in certain industries are concerned that AI will take over their roles, which causes hesitation in embracing these technologies. Additionally, organizations struggle to adjust their traditional work structures to integrate AI, and may hesitate to make substantial changes without seeing quick returns on their investments.
- **Limited Research and Development (R&D**): While AI research in India is progressing, it still lags behind countries like the US, China, and several European nations in both scale and impact. One of the key factors limiting progress is the insufficient funding allocated to AI research and development. Additionally, India's R&D challenges are compounded by a lack of essential infrastructure, such as high-performance computing and access to vast datasets, both of which are crucial for developing sophisticated AI models. This funding gap also contributes to the brain drain, as top AI researchers and professionals often move to countries offering better resources and opportunities.
- **Diverse Languages:** In India, where linguistic diversity is immense, communication systems powered by AI that can engage with users in their native or preferred languages would offer the greatest effectiveness. However, a major challenge arises from the limited machine-readable corpora of vernacular languages available for training natural language processing and creation algorithms. At present, there is a stark contrast between AI systems that can understand and interact in local languages versus those that only operate in English or are bilingual. For an AI-powered communication platform to be effective in delivering banking or financial services, it must be able to understand the customer's spoken language and respond in that same language.

- **User Capability Range:** It can be challenging to phrase questions or requests in a way that AI can understand, particularly given the wide range of customers who use financial services, each with varying levels of digital literacy. For a financial or banking service to function effectively, the information provided by customers must be both relevant and comprehensible to the AI algorithms in use. Only then can customers pose questions, and AI systems will be capable of understanding them and delivering accurate responses.

Conclusion

AI is revolutionizing banking and financial services in India by boosting efficiency and refining decision-making processes, including fraud detection and credit assessment. It drives automation, cuts operational costs, and facilitates the delivery of personalized service. The banks are increasingly leveraging artificial intelligence (AI) to transform customer service, as the technology grows in prominence. In the future, AI will play a pivotal role in the banking sector. With AI's introduction, customers can now carry out transactions at their convenience, anywhere and anytime, without the need to wait in long lines at physical branches. As AI technologies advance, their integration is sure to bring about more innovative solutions, providing enhanced convenience, efficiency, and security for both banks and their customers. Virtual assistants, chat bots, holograms, bodily robots will modify through years to flood the market because of all of the reasonably-priced technology. Despite its advantages, challenges remain in AI implementation, such as data and security, user capacity, lack of skilled workers and regulatory compliance. For the successful implementation of AI in banking sector, following are the recommendation to overcome the challenges:

- **Skill Gap and Workforce Resistance**: some of the current jobs will be taken over by AI application in banks so bank should focus on enhancing employee skills by providing AI-centered training programs and partnering with academic institutions to create tailored courses in AI and data science. Implement a gradual AI adoption strategy to ensure smooth adaptation for employees.
- **Interactive Interface**: Enhancing Customer Relationship Management (CRM) systems with chatbots boosts their performance. These chatbots can understand the context and emotions in customer interactions, responding appropriately to inquiries and improving the customer experience.
- **Maintaining Customer Connections**: While AI can mimic human functions, it still lacks emotional intelligence and empathy, which are key elements in customer service. AI can assist customer service managers by improving interactions, but it is important to strike a balance between AI-driven recommendations and maintaining personal connections with customers. Regular customer interactions and feedback through surveys can maximize AI's benefits in customer-facing roles.
- **Data Availability and Quality:** Banks can partner with fintech startups and external data providers to enhance the quality of data collection and purification. By utilizing data from digital transactions, such as those generated by the Digital India initiative, they can build more detailed and precise datasets. This collaboration will help establish a robust database for training machine learning models, improving the performance of AI algorithms. Additionally, working with fintech companies can facilitate the digitization of data, particularly in rural and underserved regions, enabling broader access to high-quality data for AI applications.
- **Customer Trust and Transparency**: Adopting explainable AI (XAI) methods allows AI models to be more transparent and interpretable for users. For instance, if a loan application is rejected by an AI system, it should provide clear and comprehensible reasons for the decision. By educating customers about how AI operates and its advantages, banks can foster greater trust. Ensuring transparency in AI decision-making, communicating effectively, and educating clients will address concerns and enhance customer satisfaction.
- **Regulatory and Compliance Issues:** Banks need to actively collaborate with regulatory organizations like the RBI to shape new policies that promote the responsible and transparent use of AI. It's vital for them to establish robust data protection protocols, such as encryption and strict access controls, and comply with privacy regulations like the Personal Data Protection Bill. Additionally, banks must implement ethical AI practices to ensure that AI systems are equitable, accountable, and operate transparently.

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