THE ROLE OF AI IN PERSONALIZED BANKING SERVICES: HOW AI IS USED TO TAILOR FINANCIAL ADVICE AND PRODUCT OFFERINGS TO INDIVIDUAL CUSTOMER NEEDS

Teja Reddy Gatla

Sr. Data Scientist, Associate Director, Department of Information Technology

ABSTRACT— Artificial intelligence has made a substantial impact on the banking and financial sector, and this impact is most evident in the way individuals and institutions save, move, and manage their money. It is improving and adding efficiency to banking services by giving these services a personalized touch. AI solution providers are continuously creating algorithms that allow financial institutions to analyze their customer data and offer services that are tailor-fit to each individual customer [1]. Whether the financial institution is a private bank, wealth management firm, or a retail bank, the objective of these AI-driven platforms and tools is to provide guidance and services for their clients that mimic those of a human advisor. These tools learn from historical data on client behavior, preferences, and engagement to offer financial advice that is relevant, timely, and personalized. AI is making it cost-effective to offer small-sized or younger client segments access to financial advice that has traditionally only been available to wealthier clients using in-person engagements. The client can have access to a one-to-one financial advisor and step-by-step instructions based on their personal saving and investment situation that can be monitored if there are any changes. The debt repayment advice can evaluate the interest rates and terms of the borrower's loans whether the rate of return of the investment is higher or not, can determine the cost of tax and the future investment opportunities in light of which the advice is sensible [1]. Ai is a very powerful tool in monitoring the customer and their financial goals. This solution can be used to compare the clients investments against the optimal portfolio allocation and also notify clients about any suggested actions that need to be taken within the limits of their tax implications or any law changes that affect these clients. Wealth management is currently experiencing an AI-driven boom and will continue being used to develop many more AI service applications in banking.

Keywords— AI methods, personalized banking, finance, transactions, customers, financial flow, banking services, blockchain, cryptocurrency, Bitcoin

I. INTRODUCTION

In the past years, AI (Artificial Intelligence) has achieved a lot of popularity when it comes to commercial applications of personalized banking services. This study provides an analysis of how AI is being used to make banking more personalized using customers' data and how this is fundamentally changing the customer experience[2,1]. Technology has a tremendous impact on the world that we live in and the financial world is not an exception. Technology has influenced many aspects of banking. One such area is customer-facing technology that uses personal customer data. Customer data is a valuable asset to many companies and is used for many purposes. So it is no surprise that the banking industry is also taking advantage of this. This has led to the emergence of personalized banking services[2].

AI is used in many different types of institutions for the purpose of improving the quality of services. However, while much of the literature in this field assumes that AI applications lead to improved performance, little has been said about whether the impact of AI tools actually reduces costs for firms[3]. AI is expected to have an impact on industry dynamics. This can already be observed in the changing pricing structures in the personalized banking services industry. In order to personalize advice for a consumer, the AI tool ingests and processes all of the consumer data. Step one is to personalize the advice for the consumer. This in itself is a departure from industry norms, where typically more detailed and higher quality advice is reserved for wealthier clients. Advice can be tailored for specific needs, such as investment or retirement planning. This is a stark contrast to industry-wide advice and is often considered a positive, as there are certain types of advice that are not optimal for a consumer at a given time, or are too costly to implement. An example of this could be a home equity loan when interest rates are not favorable [4]. The final step is to evaluate and implement a recommendation. The expectation is that using AI tools to implement advice will further increase the success rate of the advice. This is because the implications of the advice will already have been simulated by the AI and can be compared with the current scenario of the consumer using more traditional decision trees [5].

Personalized banking services should offer "anytime and anywhere" access to its clients. With the pace of fast improvements in artificial intelligence, banks and credit unions are gearing towards greater digital transformation, especially in customer interactions. The banking institutions are required to analyze and interpret its petabytes of data to gain a holistic understanding of its customers while needing to offer smarter solutions in the most efficient and fastest manner possible [6]. Personalized financial advice implies understanding an individual's holistic situation and offering advice or solutions. This can range from simple budgeting and spending analysis to complex investment planning and tax optimization. AI has made substantial progress in this area, and its capabilities to the banking sector are immense. This area of AI in personalized banking shall be divided into two categories: advice generation and advice delivery.

II. RESEARCH PROBLEM

The main research problem that will be addressed in this analysis is to explore the roles of artificial intelligence (AI) in commercial applications particularly in personalized banking services. In the recent past decades, we have seen success in AI, such as self-driving cars, chess master-level game systems, and many medical diagnostic systems. These triumphs are great and hint at a bright future for AI. But are these processes and successes any match for human-level intelligence? The answer to this question is complex and varies, but it's safe to say that the AI systems today are very far from matching human intelligence. However, they are capable of offering a level of intelligence to perform a valuable function in a given domain. AI organizations are currently unprecedented or missing within financial organizations, such as banks and insurance companies. AI adoption has been incredibly small compared to the potential benefits, in contrast to the large amount of regulatory changes [6]. These regulatory changes have created high supply costs for capital and liquidity bordering on pressure constrained bank returns across various sectors of the financial industry. It has been observed that AI transformations are mostly an implementation cost which banks are reluctant to incur, thus the aforementioned regulatory changes have affected the feasibility of AI projects. The higher costs and tightly controlled environment (especially in the USA) have affected modeling and quantitative analysis teams, raising questions on the validity of their work while increasing costs. AI systems, such as automated trading and risk management, require a high level of advanced skills in modeling, prediction validation, and optimization under constrained conditions, thus they would benefit greatly from qualitative analysis data and reduced regulatory barriers due to potential cost savings [7]. However, the fall of 2018 exposed new systemic and media risks issued toward tech firms whose AI-powered products could compromise customer and trader confidence in clear and less risky outcomes. AI models and machine learning heavily rely on data and feedback to optimize and accordingly improve performance and profitability, however data-driven approaches are currently experiencing upper limits in the aforementioned target areas amidst higher costs. Market efficiency changes enabled by MiFID II and various other regulatory measures are expected to impact a wide range of market participant organizations and reduce costs for customers, but AI developers within financial organizations are yet to assess how they will balance these regulatory changes occurring with data suitability [8]. In the future, a shift from current modes of production to generation and testing in clinical conditions could result in an upswing of advanced AI research in an effort to develop more positive market understanding and customer outcomes.

III. LITERATURE REVIEW
A. ARTIFICIAL INTELLIGENCE

Artificial intelligence is the core of computer science, which emphasizes on developing software or machines that exhibit human qualities. AI is a perfect combination of various technologies that enable the computer to perform tasks that require human intelligence. The tools involved in AI include learning, reasoning, perception, and so on. AI is frequently used by various fields and is slowly making its way into the banking sector. With the help of AI, banks are striving to build a one-to-one marketing capability to offer new products and services before their customers ask for them, increasing customer loyalty[9]. The recent growth in AI and related technologies has been remarkable. According to research, about 44% of banks and credit unions have planned to use predictive analytics provided by AI in the next 18 months [9,10]. AI is expected to transform banks' internal processes and make them more efficient. There are several ways AI will drive changes to create value for financial institutions. Some of the ways AI will impact banking are by automating processes to reduce risk and enhance decision quality, with the consumer population in mind, and streamlining operations to focus on cost and redeploy freed capacity to more valuable usage. The value of these combined changes to the global banking economy is likely to be significant. It includes the potential to increase revenue by as much as 370 billion and the total cost savings and value creation representing up to 490 billion[10]. The role of AI in personalized banking services will be to simulate very closely the way human professionals analyze data of a client, which traditional software would not be able to perform. Personalization is becoming an important commodity in the banking industry as consumers are more willing to provide their data and think about their life decisions on a computer. 61% of millennials are happy to receive virtual financial advice tailored to their circumstances, compared to 41% of those over 35[10]. This is in contrast to the public conception that older people are resistant to technology, but the common assumption is that older generations are more complacent with their financial position and thus less likely to change. At present, there exist many virtual advisers created by conventional software, but they are often poorly utilized. By using AI, it will be possible to create a virtual advisor that would be effective and simulate the approach of a real financial advisor[10]. This can be achieved by giving the advisor a set of highly complex rules to follow, but this has limited success as financial problems are highly context-dependent and rules can be contradictory. The more beneficial approach would be to use techniques of machine learning to have the advisor learn from data/examples and improve its advice over time. Machine learning can range from simple data analysis to the use of complex algorithms. An AI advisor could perform data analysis on a client's behalf to investigate a financial product or investment. In the case of a complex algorithm, AI could be used to automate the process of, say, a tax optimization strategy, which would normally be done by a tax professional. This would demand highly intelligent software and is still a vision for the future. Machine learning also has the potential to remove hazardous financial products, for example, through the use of predictive models that would isolate products that have caused financial grievances in the past.

B. IMPORTANCE OF AI IN PERSONALIZED BANKING

With increasing consumers' demand for personalized financial services, the banking industry is currently focusing on using artificial intelligence (AI) in attempts to make their services more attractive. AI enables distillation of large, complex data sets into simple, easily digestible information. This can help banks to understand their customers better and therefore enable them to provide what the customer really wants. AI can be the key in providing a solution and maximizing the benefits

of delivering personalized services at a cost customer are willing to bear. AI has a great role in understanding consumer behavior[11].
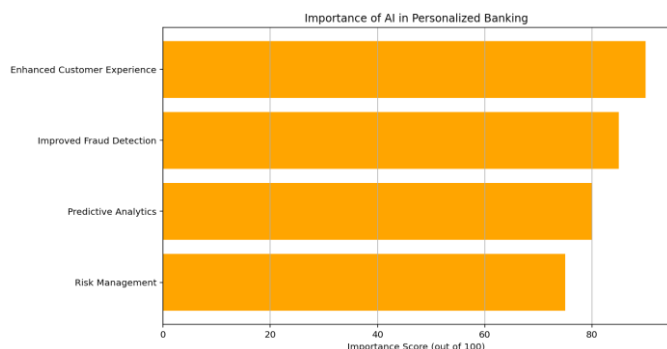

Fig. 1 Initial prototype of the device

AI can be implemented to predict customer behavior in terms of product purchase, the timing of the purchase, and the products the customer likes that cause the behavior. By understanding the behavior, banks can provide the right products at the right time to the right customer. The push marketing strategy, avoiding the product that could cause negative behavior to the customer, can also be done, aligning customer interest and the right products. In essence, banks will be able to enhance their strategy of getting maximum profitable results from each customer. The concept of AI can also help banks in bringing a more consultative approach in dealing with their customers. By implementing software or applications that employ interactive Q&A sessions in building financial plans, it will create a better understanding of customer needs and deliver the suitable steps in reaching their goals[11]. The intelligent software that acts as a virtual assistant can guide customers in taking the decisions and actions on their financial plan. AI can be used to analyze customer information and past interactions with the bank to predict the best time and channel to contact the customer. This benefits the customer in not missing important information from the bank and receiving better service from the bank.

C. AI TECHNIQUES FOR TAILORING FINANCIAL DECISIONS

The current financial product-centric approach practiced in banking is likely to get replaced with a customer-centric approach through personalized financial advice. AI techniques will facilitate the development of intelligent financial advisor systems that can assist consumers in a variety of financial decision-making tasks. These systems simulate the knowledge and expertise of a human financial advisor and are capable of providing reasoned and intelligent advice. An example is provided by the work reported in [12] which outlines a system using fuzzy logic to provide personalized advice on which credit card best suits a particular consumer. This is achieved by comparing the attributes of the consumer with the features of various credit cards in order to make a recommendation. Another example is the decision support system for mortgage loans reported by [12] which employs case-based reasoning to provide detailed advice on choosing the best mortgage for the consumer's circumstances. The advice provided by these systems ranges from simple classification of consumers with respect to a product to complex advice on possible financial strategies. Decision support systems can help tailor advice by evaluating different alternatives open to the consumer. An example is the work by [13] on an automated financial consultant for retirement plans, which applies dynamic programming to find an optimal strategy for a retirement plan based on the current and future financial situation of the individual. The most effective advice is that which is specific to an individual's circumstances, and AI techniques provide the means to achieve this by automating the

process of knowledge elicitation and representation for expert advice.

D. AI APPLICATIONS IN CUSTOMIZING FINANCIAL SERVICES

Trees and similar methods can obtain better segmentation of customer needs in designing banking products. For example, a new future for data mining will automatically transform data into customer needs and product enhancement. Bank products can be tailored and targeted more specifically to the needs of consumer groups. ANZ Bank in New Zealand has piloted a data warehousing project to learn more about customers and predict which products many may need in the future[14]. This could be achieved by building a decision tree to isolate the specific group that the new product would target and predict the best outcome based on that group's future expectations. Another, using a similar type of concept, machine learning can introduce an artificial program that learns through experience to make automatic improvements in targeting customer needs with specific product features. From a grouped dataset, the program can adaptively change the product feature levels to better meet the needs of that specific group. Simulation-based systems can be used to continuously test strategies for customer product offers. It had been thought that these systems would be limited to only deterministic mathematical programming type models [15]. However, new technology in agent-based simulation can provide a more flexible approach involving the building of artificial intelligent agents to represent the customers and the product competitors in the simulated environment. From this, a dynamic model of customer and competitor behavior can be built and continuously tested over time to predict the best product offering strategy for different customer segments. In a study by [16], agent-based modeling had been used in a decision analytical model to compare different types of customers and different types of loans in the retail credit market in Germany in determining the strategy of a particular credit product depending on the needs of certain customers. This type of intelligent system can provide continuous analysis and simulation to improve dynamic learning and further product customization.
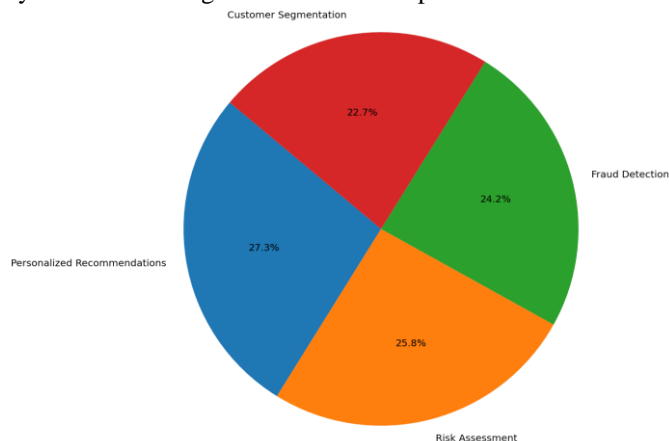
Fig. 2 AI Applications in Customizing Financial Services

IV.   CHALLENGES AND LIMITATIONS

Personalized marketing is a priority for the retail banks, but success is often elusive. Many banks have attempted to implement personalization systems with mixed results, due to the complexity and long organizational lead times needed to make changes. There is strong demand for marketing automation systems that can adapt to changing customer needs and bank strategies, measure effectiveness, and rapidly scale successful tactics [16]. AI technologies such as automated learning and optimization can provide tools to make this possible for both online and offline marketing, but to date most marketing technology investments have focused on data management and channel integration.

Fig. 3 Challenges and Limitations of AI in Customizing Financial Services

Personalization in banking is aimed at attracting, keeping and growing the most valuable customers, improving satisfaction and loyalty, and optimizing the value of the customer for the bank. Any customer contact is viewed as a moment of truth, in which the bank has an opportunity to make the right offer, provide the right service, or sell the right product. Personalization is of particular importance in the online channels, where human interaction is limited and the ability to influence customer behavior is largely determined by the relevance of the site content, the simplicity and intuitiveness of site navigation, and the effectiveness of online sales and service processes [16]. AI technologies can be particularly useful in online personalization, due to the availability of large amounts of data on customer behavior, and the low cost and high flexibility of automated methods.

V. SIGNIFICANCE AND BENEFITS

The significance of AI in providing personalized banking services is groundbreaking. Financial institutions in the United States are beginning to utilize artificial intelligence in various forms. For example, Chase has created a program called COIN (Cognitive intelligence) which is enabling its legal team to review complex contracts in a fraction of the time it once took. AI has also seen a growth in the form of chatbots virtual assistants displayed by companies such as Capital One and American Express [17]. These assistants are able to respond to customer queries and in some instances are able to offer financial advice. It is still early days for these types of programs, but the goal is to collect enough data on customers to be able to offer personalized financial advice at some point in the future.

Financial institutions in the U.S. are fast embracing AI technologies to enhance deliverables and meet the expectations of the growing base of digital consumers in a cost-effective way. This asymmetric technology, when combined with the large customer data available with the banks today, can lead to optimized customer service. AI can be used to automate customer interactions through chatbots or virtual assistants. This can provide a very convenient and consistent way for customers to get information across a range of simple service issues. For more complex issues, the same chatbots could be used to quickly connect the customer with the right service representative by providing that representative with a pre-analysis of the customer issue and the most relevant customer information. This could potentially save customers' time and help banks to more quickly resolve customer issues.

With AI, banks can analyze customer behaviors and understand their needs at an individual level, which in turn can enable the development of more personalized products and services. For example, predictive data can be used to model different future scenarios and understand their impact on customers. Tailored banking products can then be developed to meet the needs of different customer segments. AI can also help banks identify the most effective channels to communicate with customers [17,18]. Today, customers are bombarded with offers from multiple sources. By knowing the channel preferences of their customers, banks can create a more targeted and positive customer experience.

With the current technology, consumer data can already be collected and analyzed from a variety of sources including social media, search histories, and smartphone GPS data to create a detailed profile of an individual's financial situation, their behaviors, and their future needs. This can be used to design a personalized service for each customer. One example of this is personalized investment portfolios created with the use of algorithms that were designed to maximize long-term returns, taking into consideration an individual customer's tolerance for risk. One of the biggest benefits that AI will offer to consumers is the 24/7 availability of its services. A study from Money And Mental Health revealed that consumers with mental health problems are three times as likely to suffer financial difficulties. These people are often the most in need of good financial advice but are obviously limited by the current banking hours. With AI, these customers will be able to access the same level of advice as any other consumer at a time that suits them.

VI. FUTURE

The changes and benefits to come in AI personalized banking services in the long-term future are vast and may transcend the habits of customer interactions. An example might be the future eradication of banking branches and solely having virtual interaction and transactions. Verizon's Chief Data Scientist Ashok Srivastava believes that with the progression of automation, machine learning algorithms, and improved systems connectivity, future AI will achieve a state where decisions and actions will have the maximum positive impact and minimum risk. This will likely mean algorithm decisions that are error-free or have the least negative impact, which may imply less need for customer input in his ideal future decisions. Nonetheless, the future of AI personalized banking services will always be aimed at providing customers with the best suitable solutions for their financial needs and aspirations.

This advanced AI technology and personalized banking system will enable banks to understand each individual customer better compared to before. It is depicted that machine learning employed in AI technology will be so advanced that it can simulate humans to understand customer needs and provide the best suitable solutions for them [18,19]. This is also linked to cognitive computing, where future AI systems can potentially replace humans to provide expert advice. An example scenario would be a customer simulating a discussion with his virtual agent regarding a health issue and diet. In the end, the virtual agent can offer banking services to adjust the customer's investment in a health insurance policy or provide newly packaged insurance products related to health and diet. Step by step, AI technology will compile and process immense data and become a virtual decision-maker for the best suitable options for each customer [20]. AI technology will sift through highly diverse data ranges: spending habits, life events, credit and banking history, and any financial aspirations or concerns. With this information, AI can formulate and provide pre-emptive solutions before problems arise and thus improve on usual reactive solutions after an event has passed. An example of a pre-emptive solution could be an automatic credit limit increase or decrease with better interest rates based on credit history changes.

VII. CONCLUSION

The main focus for this paper was to assess the roles of artificial intelligence (AI) in commercial applications particularly in personalized banking services. The current revolution in digital technology largely influences human life. One particular sector that has experienced enormous influence is the banking sector. Digitization has resulted in dramatic changes in the processes of stock trading and other services offered by stockbrokers. The personal banking segment is in general quite

successful in terms of its implementation of information technology. Several complex software packages are widely used in areas such as lending and mortgage. However, AI technology potentially to transform personal banking is still in its early stage. The evolution of AI and related technology has huge potential to automate various tasks currently performed by human beings, and lead to cost savings for banks. At the same time, there is also a growing trend for solutions to intelligent agents to be applied to a wide range of complex problems and thus more advanced AI methodologies will become relevant to a greater diversity of banking applications. In this context, the term intelligent software agents comprises predictive tools based on customer data analysis and the decision making software used in automation. Both types of software will rely on data having to be extracted or it has been specified by the bank's customers and increasing interaction with customers. In turn, this represents increased use of data mining and potentially intelligent user interfaces, such as avatars. These technologies have the potential to bring the fruits of AI research to the general public and some are quite novel from an application viewpoint. The days of empirical decision making in personal banking could be numbered.

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