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Application of AI with Fintech in financial services sector

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Abstract

Abstract: During past several decades, amazing technology advance in Artificial Intelligence (AI), Big data and Machine Learning have been achieved and witnessed. AI plays a vital role in the digital transformation process of all sectors, especially within the domain of Finance. This paper reviews the application of AI with Fintech in financial services sector, analyzing how AI, Machine Learning, big data analytics and other Fintech techniques are being deployed to improve decision-making such as credit scoring, risk management, portfolio management and market prediction, improve efficiency and reduce costs while enhancing customer experience and engagement at the same time. The paper synthesizes recent advancements in AI's application along with the evolution of Fintech in the financial sectors, summarizes AI techniques used, explore most common application areas of AI techniques, and discusses potential challenges AI brings to humans. It highlights how AI is reshaping the landscape of financial industry, and what academics, regulators, financial institutions, and Fintech companies need to do to leverage the benefits of AI while addressing the potential risk or problems it brings to the whole society and economy.

CCS Concepts

- Computing methodologies; • Artificial intelligence; • Natural language processing; • Information extraction;

Keywords

Artificial Intelligence, Machine Learning, Fintech, Financial Services Sector

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Introduction

With the rapid development of Artificial Intelligence, more AI-related models and techniques are deployed within the domain of finance. AI along with other technique advancements has changed the traditional way financial sectors provide products and services

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to their customers. In the process of digital transformation, understanding the impact AI imposed on the whole industry and managing the potential risk or problems is crucial for financial service professionals, policy makers, legislators and educators. Integrated with techniques or models used in big data analytics such as support vector machines (SVM), and deep neural networks in Machine Learning (ML), AI can help leverage the big data sets generated from financial service sectors and social media and improve prediction accuracy and risk management efficiency. In the foreseeable future, advancements in the fusion between technology and financial services can offer novel solutions that allow financial processes to be more efficient in terms of cost and speed, hence reinforce the agility and resilience of the financial sectors.

From the birth of AI (1950s-1960s), funding and enthusiasm in AI increase on the whole, and technical innovation in AI explodes in recent years. 1980s saw the development of expert systems and AI boom, 1990s-2000s witnessed the rise of Machine Learning, and since 2010s, great advances have been achieved in Deep Learning, leading to breakthroughs in image recognition and other areas. The launch of OpenAI's GPT-3(2020) and GPT-4(2023) marked a revolution in natural language processing, tools like ChatGPT (2022) brought generative AI to mainstream use.[1]

According to Artificial Intelligence Index Report 2024, AI beats human in areas such as image classification, but fall behind on more complex tasks like competition-level mathematics. Investment in generative AI surged, nearly occupying from 2022 to reach \$25.2 billion. The training cost frontier models have reached unprecedented levels (for example, Google's Gemini Ultra used an estimation of \$191 million for compute).[2] The most recent advancements in LLMs include Grok-3, launched on February 18, 2025 by xAI, and DeepSeek-V3, released on December 26, 2024 by Chinese AI startup, which achieved high performance with relatively low-cost. [3]

Survey on AI indicates that AI adoption has jumped to 72 percent, compared to about 50 percent for the past six years, and the biggest increase in adoption can be found in professional services.[3]

While advances in AI attract people's attention across the globe, they do increase concerns of society about AI. A survey from Ipsos indicates that 52% express nervousness toward AI products and services, rising from 39% in 2022. In recent years, governments and organizations worldwide began addressing AI ethics, bias, and regulation. EU AI Act entered into force on 1 February 2025, established ethical guidelines, privacy protections, and safety standards for AI development and deployment. (The Bletchley Declaration, 2023) achieved on the UK AI Safety Summit saw global cooperation on AI safety and governance by 28 countries, including the US, UK, and China.[4]

This paper aims to explore how application of AI, integrated with other Fintech tools like big data analytics and Machine Learning

has changed the financial sectors' landscape. To put it in more detail, this paper tries to review current AI-related methodologies and tools used in financial sector, identify the pros and cons in applying AI-related techniques to financial sector, especially the challenges with the adoption of AI, and propose future research directions for better employment of AI.

A comprehensive literature review methodology was used for conducting this review. The sources of literature including some websites, such as <http://crs.hnlat.com/>, <http://www.spischolar.com>, from which peer-reviewed journals, industry reports, and case studies can be downloaded and analyzed subsequently. For the articles reviewed, the selection criteria are the quality and relevance to the application of AI in financial sector. Keywords combination such as "AI+ Fintech", "AI+ Machine Learning/ Deep Learning", "AI+ Big Data" were used to search for appropriate articles or research, as a result, over 130 articles were found and reviewed, but those written in a language other than English were excluded in this study. Both theoretical and empirical analysis are examined to get a better understanding of the impact of adoption of AI in financial sector.

1 Key Concepts and AI techniques deployed in FINANCIAL SECTOR

1.1 Artificial Intelligence, Machine Learning, and Deep Learning

There is no consensus on how to define the term Artificial Intelligence (AI). AI is the 'science and engineering of making intelligent machines', as the father of AI, John McCarthy outlined.[5] As defined in a review, Artificial Intelligence refers to the ability of machines to perform tasks that typically require human intelligence.[6]

According to application domains, AI field can be divided into several main branches: image or visual identification, NLP operations, heuristic problem solving and expert system design, which can be performed based on the ability of AI to learn and improve performance, and human interaction is not essential in this process. This kind of ability of AI is referred to as ML capability.[7]

Deep learning (DL) is a subset of machine learning which is often used in high-frequency trading, market prediction and credit scoring.[8] In order to extract complex patterns from datasets, artificial neural networks with multiple layers are deployed to improve prediction accuracy and risk-management efficiency.

Recent advances in Fintech have shown how machines can learn to solve problems and make decisions with training data, whether structured or unstructured. Expert systems, machine learning, deep learning and other techniques can be deployed to achieve AI. Thanks to recent advances in computer science, Artificial Intelligence can be approximate by studying and designing various intelligent agents to offer real-time response and efficient solutions to tough problems.

1.2 Fintech: Definition and Classification

Over the past several decades, financial Technology (Fintech) has been at the center of recent developments in the finance industry and attracts the attention of academics all over the world.

As a study conducted defines, Fintech refers to technology-enabled financial solutions. The authors follow a timeline that starts before the 1970s and point out that Fintech has evolved over three distinct eras: Fintech 1.0 (1886-2007), transition from analogue to digital services; Fintech 2.0 (1967-2008), development of traditional digital financial services; Fintech 3.0 (2008-present) led by start-ups, application of rapidly developing technology.[9]

Following a study by Imerman and Fabozzi, the fintech ecosystem is split into traditional fintech segments (fintech verticals) and traditional operations and applications (fintech horizontals). Fintech horizontals consist of emerging technologies for financial services, such as IoT (internet-of-Things), AI, Big Data Analytics, Cloud Computing, etc., and functional areas like financial regulation, risk management, funding and valuation. Fintech verticals include payments technology, digital banking, FinTech lending, equity crowd funding, InsurTech and PropTech, etc. Emerging technologies are dominated by big data, AI and ML or advanced derivatives of them and their efficient combination (APIs, Cloud and Quantum computing, Cybersecurity, automation).[10]

1.3 AI Techniques Deployed in Financial sector

Based on high-frequency financial and market information clustered in the financial sectors, financial institutions can deploy various AI techniques to respond to the fast-changing market in real time, thus enhancing the agility and resilience of financial sector. In this study, AI techniques used in Big Data Analytics are at the center of Fintech-related analysis. Other techniques such as cryptocurrency and blockchain may be addressed occasionally, but not as the focus of this article.

Big data analytics could be defined as the complex process of delving large and varied data sets, in which vast time and computing are essential to identify unknown information or specific patterns such as customer preferences. AI techniques used in big data analysis are powerful decision-making tools that enable financial sector to improve their efficiency while reducing risk and costs in business operation.[11] This is crucial for the survival of financial sectors in the battle of digital transformation, because they are top data producers in all industries. The combination of AI techniques with Big Data Analytics is essential in handling unstructured, sophisticated financial data, which conventional analytics approaches cannot easily cope with.

Key AI techniques used in Data Analytics include Machine Learning (ML), Deep Learning and Natural Language Processing (NLP). Machine Learning uses various algorithms to learn automatically from data and improve over time without direct human interaction. Machine learning models widely applied for market prediction and risk management in financial sector are support vector machines (SVM), decision trees and deep neural networks. Deep Learning focuses on neural networks with many layers, and it is very efficient in identifying complex data patterns. It can find the correlation between the subsets of data and provide best predictions or decisions for the task given. Natural Language Processing techniques can be used to process unstructured text data, such as social media posts. As a branch of NLP, Sentiment analysis is widely used in market prediction, which can extract useful information from social media

and financial reports or news, perceive the sentiment of financial market, thus provide more accurate prediction about market trend.

2 current applications of AI with FINTECH IN the financial industry

In the past several decades, Artificial intelligence has been widely utilized by financial institutions, and it is the revolutionary driven force that brings a profound change to the financial industry. Advances in AI, such as ML algorithms and natural language processing, are adopted by FinTech systems, enable financial institutions to use big data analytics to process huge volumes of data and make predictions or judgments. [12] Application of AI with Fintech is changing the way financial institutions facilitate their business. This section focuses on core areas where AI techniques have been effectively applied in the financial industry: market prediction, financial trading, risk management, and customer targeting and engagement.

2.1 AI Application in market prediction

This subsection summarizes AI techniques used in market prediction: sentiment analysis and predictive analytics. A study explores the integration of AI-driven techniques in Big Data Analytics to enhance decision-making capabilities in the financial sector. The author illustrated that predictive models, such as support vector machines and neural networks, are deployed to forecast market trends by analyzing big datasets composed of historical and real-time data. Natural Language Processing (NLP) is widely utilized in sentiment analysis to assess market sentiment by extracting opinions and emotions from textual data, such as news articles and social media posts, and make judgement on market trends. In this research, quantitative methodology is used by analyzing historical financial data from major stock exchanges with different AI-driven models, and the author found that compared to traditional methods, neural networks and sentiment analysis tools significantly improve prediction accuracy and market timing.

Machine learning models such as neural networks, linear regression, support vector machines (SVM), and decision trees, are widely applied to forecast market trends, learning from past datasets, identifying data patterns, and utilizing them to new datasets to improve predict accuracy. In sentiment analysis, NLP techniques such as tokenization, and named entity recognition (NER) are used to break down and analyze huge datasets, to identify market sentiment movement. For example, in stock trading, AI-powered predictive models allow investors to forecast market movements based on technical and fundamental indicators and help them to identify appropriate timing in stock trading.

2.2 AI Application in financial trading/investments sector

Algorism trading utilizes AI-powered algorithms to automate trading strategies. Based on predefined rules, these AI models are designed to execute trades and optimize real-time decision-making, handling huge volumes of data, and make decisions automatedly at extremely high speed without human intervention. AI models applied in algorithms include decision trees, reinforcement learning

and deep neural networks, which can develop real-time trading strategies during market volatility.

High-frequency trading (HFT) is commonly deployed in algorism trading. Machine learning models with HFT algorithms can identify opportunities in real time and make profit from small price differences that only exist for extremely short time. Speed, precision, cost efficiency, and risk management are all benefits of algorism trading. In the investments sector, a phenomenon was observed that clients move from active funds into passive funds managed by robots within an investment firm, because of higher fees charged by active funds.[13]

ML-driven algorithms can identify factors from huge volume datasets that humans have not, but just as indicated in a study, like Bridgewater and many of BlackRock's funds, some quantitative funds use algorithms to analyze big data, but call on humans to select trades, because human analysts still need to understand and interpret what ML has identified to be new explanatory factors. Many quant funds, such as Renaissance Technologies, are utilizing ML and DL techniques to pick stocks and execute automated trading.[14] Although most AI-driven systems in production relied on manually crafted rules, there is likely to be more widely used of NLP in the future.[15]

2.3 AI Application in risk management

Fraud-detection and credit scoring are another area widely used AI techniques. It is vital for financial service providers to limit potential losses by detecting financial frauds in real time or identify customers that may default in the future. With the help of AI models, banks, investment firms and hedge funds can analyze large datasets in real time and improve their risk management efficiency.

Network models, big data analysis and text mining have been used to help economists understand systemic risk, because network-based models are more efficient than humans in big data mining and analyzing. ML/DL technologies are deployed to identify potential customers by calculating affordability and likelihood of default, even for those with no formal credit history and no bank account. By installing an App on mobile phone, data will be collected and processed to estimate risk and disburse funds within minutes if approved. As quoted in Arvind and Heinz' paper, respondent 4 argued that ML algorithms reduce the cost of dealing with these financial frauds and speedy detection. Blockchains' emerging technology may be utilized to improve the borrowing process and reliability in peer-to-peer systems.[15]

Banks and lenders use credit scoring to assess the solvency of borrowers. A credit scoring algorithm contains risk factors and their weights in the decision-making process, during which weights are assigned on the relative importance of the risk factor in making the subject a bad credit.[16] In Europe, data from Facebook and LinkedIn are being used by platforms such as Kreditech to rate borrowers as safe or risky and decide whether to offer microloans to them or not.[17] In the context of IoT, advances in AI and ML can help institutions identify fraudulent transactions in real time, and prevent possible loss.[18]

2.4 AI Application in customer targeting and customer engagement

Financial services providers such as banks and insurance companies can use advanced AI techniques, especially deep learning models, to analyze huge volume of structured or unstructured datasets, and identify customer behavior patterns from complex data collected from daily financial transactions and social media.

Widely adoption of chat robot and robo-advisors can help financial institutions to enhance customer engagement, particularly among young people and well-educated people, who are ready to embrace technology innovation in financial services sector. The benefits of AI applications include reducing human resource costs, and prompt response to customers, better understanding of customers' needs and tailored products and services.

AI could also help the banks maintain a good relationship with customers by offering new business processes. The AI- aided bank could use customer analysis to offer counseling and provide advice and portfolio management.[19]

3 CHALLENGES IN the application of AI with fintech

Although advancements in FinTech can extremely improve operating efficiency and risk management in the financial sector, and bring tailored financial products and services to better meet customers' need while enhancing their experience and engagement, there are still challenges that need to be addressed in AI application. The transformative fusion of big data, AI and ML-favoring fintech advances is powerful, but difficult to control in some cases. How to harness these fintech advances while they evolve forward rapidly, is the challenge they pose in front of academics, financial incumbents, policy makers, and legislators.

3.1 data quality and availability

Every second there are huge amount of data generated from financial sectors all over the world. Combined with various data generated from social media and other channels, AI-based models used in big data analytics may face challenges of poor data quality, especially when dealing with unstructured data. A study shows that the accuracy and performance of AI models depend heavily on the quality and availability of the data. Risk arises from non-representative data, bias inherent in representative data, choice of algorithms, and human decisions. Inconsistent, noisy or incomplete data can severely reduce the accuracy of prediction and risk assessment. While more large language models are being used along with the rapid development of Fintech, they cannot identify data error or assess the quality of data, hence reduce the credibility of AI models. Financial institutions and FinTech companies need to ensure the reliability of the datasets deployed for training AI models, and a vigilant division of labor between AI and humans is vital in the application of AI.

Following a global survey, 70 percent of Gen AI high performers have encountered other challenges with data, such as insufficient amount of training data, developing the ability to quickly integrate data into AI models, etc.[3]

3.2 Inaccuracy of the Models or explicability of Algorithms

Another concern focuses on the “black box” nature of certain AI models, or lack of transparency in decision-making process, particularly deep learning models. Deep learning models have many layers, and it is a tough task to explain how they arrive at certain predictions or trading decisions. In the highly regulated financial industry, this failure in explicability of algorithms can cause regulatory and ethical concerns. More explainable AI may be essential for the welfare of society and regulatory purpose in the future. Financial institutions FinTech companies need to comply with regulatory requirements to ensure transparency and fairness when deploying AI models in the process of decision-making. On the other hand, evolution of Fintech poses challenges for regulators and market participants to balance the potential benefits of innovation with possible risks of new techniques. Real-time compliance is needed in highly regulated financial sectors. Development of regulation technology (RegTech) which can monitor the models and operation process is crucial for regulators, to adapt to technique changes in digital age.

As AI Index Report 2024 shows, lack of transparency, especially on training data and methodologies disclosure, hampers efforts to better understand the robustness and safety of AI systems.

Respondents to McKinsey's global survey are more likely than they were last year to consider inaccuracy as the most experienced risk of gen AI adoption, followed by cybersecurity and explainability.[3] Data managements risks such as data privacy, bias or intellectual property (IP) infringement, with model management risks together, tend to lead to inaccurate output or inexplicability of the models.

3.3 Ethical challenges on labor market

There are several challenges with the evolution of intelligent agents, automation and algorithmic modelling, among which labor displacement may be an ethical challenge AI brings to human society, as mentioned by some academics or practitioners in their research. McKinsey Global Institute forecasts that automation can crop around 30% of the hours worked globally by 2030, especially in the financial services sector.[20] Banks and other financial institutions are deploying chat robots to implement customer interaction, recommend customized products and services to give their customers satisfactory solutions in real time. Increasingly adoption of chat robots and robo-advisor may cause anxiety of employees in financial services sector, for the possibility of losing their jobs in the future. Financial services' AI-related workforce is expected to observe an eroding effect worldwide, as elaborated in McKinsey Analytics(2019) survey.[21]

As shown in McKinsey(2024) global survey on AI, respondents are less likely than they were in 2023 to say their organizations take workforce and labor displacement as relevant risks.[3] As a result, no more efforts are being made to reduce them.

3.4 Data Security and Cyber security

Another challenge with the application of AI is related to digital privacy and cyber security. Data privacy is becoming increasingly important as financial services sector relies more on AI. Boot(2021)

discussing several policy challenges in fintech, including data regulation on competition grounds.[22] The authors regard digital platforms as natural monopolies for communication and data and use Germany's competition legislation in 2020 to explain that a one-off solution and a more holistic policy on natural monopoly respects of platforms is crucial in financial services provision.[22] Regulatory frameworks will need to evolve to address these concerns, balancing innovation with market integrity. Advanced techniques, such as Federated learning can be used for preserving end-user privacy and security, which allows AI to learn from user data in a privacy-sensitive way.

A global survey on responsible AI for business indicates that privacy, security, and reliability are among the top AI-related concerns, and organizations are beginning to take steps to mitigate these risks. However, only a portion of these risks have been reduced by most companies across the globe.

4 conclusion and future research direction

Application of AI with Fintech empower financial service sectors to be adaptive to the rapid-changing market and meet the compliance requirements in real time during the process of digital transformation. Advanced AI techniques deployed in various financial areas, such as market prediction and risk management, particularly with wide adoption of big data analytics, enable financial institutes and other emerging innovative market players to leverage the large-scale datasets collected in financial services sector, help them to improve operating efficiency and reduce costs, and provide tailored products and services to customers. Despite all the benefits technology innovation brings to financial industry, there are still some concerns on the challenges or risks of AI application, raised by academics and practitioners, such as data quality and availability of training data, explicability of algorithms, and ethical issues on labor market and data security. There is a long way to go before humans can figure out how to balance the benefits of Fintech and risks that technology innovation brings to us. This is what academics and regulators need to do in the foreseeable future. The development of RegTech is vital for achieving this goal. Future research directions include how to solve the "black box" problem in certain algorithms toward a more explainable AI, how to collect smart data in an efficient way to create value, how to improve regulatory efficiency with RegTech and promote perfect legislation,

how to design models that could better protect data privacy, and finally what measures should be taken to ensure cybersecurity.

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