

Challenges and Countermeasures of Artificial Intelligence Technology in the Application of Financial Industry

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Abstract: In recent years, the rapid growth of Artificial Intelligence has become a household name and has developed its use in various fields. Today's AI is permeating all aspects of the financial sector and has become a force for change. This paper summarizes the history of artificial intelligence and delves into the current state of its integration into the financial sector. The capabilities of AI herald a new era of financial innovation but also pose a number of risks and challenges. This paper combines case studies and literature to focus on the data risks faced by AI in finance, the complexity of "black box" algorithms, financial and legal regulatory challenges, and data privacy and ethical issues. As financial institutions increasingly rely on AI-powered solutions, understanding these potential risks becomes critical. This paper concludes with some countermeasures and recommendations to address the potential risks. By deploying AI through collaborative efforts, rigorous oversight, and on high-quality data, the financial community can capitalize on the power of AI to allow fintech to lead the transformation of the industry.

Keywords: Artificial Intelligence, Financial Industry, Challenges, Countermeasures

1. Introduction

With the popularization of the Internet, cloud computing and the rapid development of digital transformation, the field of artificial intelligence has been rapidly applied to various industries and has a profound impact on the economic development of society. Starting as early as 1950, Artificial Intelligence (AI) has gone through the famous "Turing Test", the rise of computers, and finally the revolution of the Internet industry and computers [1]. Until now, Artificial Intelligence has been a household name, a technology that is becoming increasingly powerful and used in a number of fields. Since the Chinese government identified AI as a key area of development in 2016, the Chinese digital platform Alibaba has established an AI lab, the launch of interactive assistant AliGenie and the development of e-commerce and payment services efficiency, among others [2]. Today it has become a diversified global giant company in e-commerce, digital payments, cloud computing and more. Artificial Intelligence (AI) in finance is the use of intelligent technologies such as Machine Learning (ML) to mimic humans and help financial institutions with data processing and decision making, risk management and improving customer experience [3]. However, with the widespread use of AI technology comes a host of risks and challenges such as data risks, "black boxes", regulatory and ethical issues. While much of the current research focuses on analyzing the current state of AI applications in various aspects of the financial sector, there is a lack of findings on specific potential

problems and solutions for AI applications in the financial industry. This paper discusses the development of AI, the wide application of AI in the financial field, the potential risks of the application of AI in the financial field and some countermeasure suggestions by means of an overview. Researching these will allow the financial industry to maintain market stability and sustain innovation while effectively utilizing AI, which is significant for the development of the financial industry.

2. The Development of Artificial Intelligence and Applications in the Financial Industry

2.1. Development of Artificial Intelligence

AI "is the study of the mental faculties through the use of computational methods" [4]. Its development has also been a complex journey, spanning multiple disciplines, decades and technological breakthroughs. The significance of the Turing test laid the foundation for the concepts of computer science and algorithms beginning with Alan Turing's development of the Turing machine in the 1940's. In October 1950, Alan Turing published *Computing Machinery and Intelligence* detailing the famous Turing test. The Turing test sparked a wide-ranging and heated debate among scholars in various fields, including philosophy, computer science, cognition, and neuropsychology, and in 1956, at a summer symposium held at Dartmouth University, J McCarthy, M Minsky, and Shanno formally introduced the concept of "artificial intelligence" [1]. However, due to the technological limitations at that time, the fervor of Artificial Intelligence did not last long. Artificial intelligence moved from rule-based systems to machine-learning algorithms until the 1980s. IBM's Deep Blue beat chess world champion Garry Kasparov in 1997. The development of backpropagation for neural networks made deep learning feasible. The 21st century has seen the rise of virtual assistants such as Siri, Alexa and Google Assistant. From image and speech recognition to gaming, AI systems have achieved human-level performance in many tasks, such as DeepMind's AlphaGo beating the world champion in the game of Go. Today's AI can converge in a variety of fields, from healthcare and finance to entertainment and transportation. Throughout its history, AI has experienced peaks and valleys. However, the resilience and continued innovation in the field have always generated new interest and groundbreaking achievements.

2.2. Artificial Intelligence in Finance

Artificial Intelligence has made significant advances in the financial sector over the past few years. The intersection of AI and finance offers many possibilities to process large amounts of data at an alarming rate, recognize patterns, and make predictions that are sometimes beyond human capabilities. In risk assessment, AI can analyze large amounts of data to identify potential risks, including credit risk, market risk, and operational risk. It can determine whether a person is eligible for a loan or predict potential loan defaults and fraud. In algorithmic trading, AI algorithms can analyze market data in real time to identify trading opportunities and execute trades at speeds unmatched by humans. In financial services, 24-hour customer support and the storage of customer data and information have made the financial sector highly integrated with AI. In particular, the launch of the Bank of America chatbot "Erica" in 2018. In addition to regulation and monitoring, portfolio management and so on, artificial intelligence has greatly increased productivity and efficiency, and even significantly reduced costs.

3. Potential Risks and Challenges in the Application of Artificial Intelligence in Finance

3.1. Data Risks

Data is the lifeblood of AI systems, powering their algorithms and determining the outcome of their operations. However, the reliance on massive amounts of data itself opens the door to major vulnerabilities. The first is the challenge of data quality and integrity. Any inconsistency, inaccuracy or bias in the data can lead to poor financial decisions. Whether a credit risk model inadvertently discriminates against a specific group of people, or an investment algorithm misreads market signals due to outdated data, the impact can be significant and costly. There are also looming data security risks. Financial data is a lucrative target for malicious actors, and because AI systems require a constant stream of data, they can be an entry point for cyberattacks. Capital One data breach, 2019. An intruder used a misconfigured firewall to access the data of Capital One's 106 million customers. While not a direct result of AI, it demonstrates the vulnerability of cloud storage, a technology often intertwined with advanced AI deployments [5]. In addition to the immediate financial impact, data breaches can seriously undermine trust in financial institutions, and once that trust is lost, it can be very difficult to recover. In addition, with respect to data bias, it is assumed that AI trading algorithms are trained based primarily on data from bull market periods. This bias may cause the algorithms to underperform or make unfavorable decisions during bear markets, which could lead to significant financial losses.

3.2. Black Box

The "black box" is similar to that in AI systems and machine learning, where the inner workings and decisions are incomprehensible or opaque to outsiders. While "black box" AI models offer impressive predictive and analytical capabilities, they operate in ways that are not easily understood or explained by humans. The opacity of decision-making poses a number of challenges. First, lack of transparency hinders regulatory compliance and complicates the process of building and maintaining trust with customers and stakeholders. When important financial decisions are made by hidden algorithms, accountability and ethical issues arise. For example, biases hidden in training data may manifest themselves in AI-driven decision-making. This could inadvertently lead to bias in loans or investment recommendations that discriminate against people of color. A 2019 Stanford Law School study found that certain fintech algorithms used for mortgages charge higher interest rates to Hispanic and African American borrowers. This amounts to discrimination, even if unintentional, because the AI's decision-making process is not clear to humans [6]. Furthermore, in the event of unexpected financial anomalies or losses, the inability to dissect and understand the inner workings of these models makes identifying and subsequently correcting problems a daunting task. In a worst-case scenario, these unexplained decisions could amplify systemic risk, especially if multiple institutions are using similar AI-driven strategies, creating synchronized vulnerabilities in the global financial architecture.

3.3. Regulatory Challenges

Regulation is primarily financial, legal, and institutional. The rapid development and adaptation of AI technology have often outpaced the development of regulation, leading to a gap between what AI can achieve and what legislation allows. The first is financial regulation. Its two main aims are to maintain the stability of the financial system and to prevent significant losses due to the failure of other large financial institutions [7]. But machine learning not only triggers data bias, but it also makes data limitations a potential risk for major losses. Machine learning enables data from normal times to help predict and identify the stability and potential risks of financial institutions during normal times. When extraordinary times come, we need some sort of parameter linked to the

determinants of extraordinary times at that time. In addition, financial regulation is inherently costly and difficult. As the development of AI increases further, so will the difficulty of implementing financial regulation. Second, the global nature of finance means that financial institutions must navigate the intricacies of international regulations, each of which responds to the complexities of AI in different ways. In essence, while AI promises to redefine the future of the financial industry, the disjointed challenges of regulation require a delicate balance between technological advancement and preserving the credibility of the industry and public trust. And most of our regulation of AI in the financial sector is limited to the level of Internet finance. Cross-border financial services utilizing AI face the daunting task of harmonizing and complying with a range of international regulatory standards that have their own positions on data privacy, consumer protection, and AI ethics.

3.4. Ethical Issues

The intersection of Artificial Intelligence and finance has paved the way for groundbreaking advancements, optimized processes, and the creation of tailored financial solutions on an unprecedented scale. However, this convergence also brings with it a plethora of ethical dilemmas that both technicians and financial professionals must face. One of the main ethical issues with AI is algorithmic bias. AI models trained on large data sets may inadvertently perpetuate or amplify existing biases. This bias can manifest itself in many forms, from discriminatory lending practices to biased investment advice that may marginalize certain groups or exacerbate existing socioeconomic disparities. These can result in legal liability and reputational damage to the company. Given that these decisions are made by algorithms, there is a risk that they will be perceived as impartial, masking potential biases, and making them harder to challenge. Secondly, the impact of AI developments on the labor market in the financial sector could also increase socio-economic inequality. In addition to this, the lure of "efficiency" promised by AI may lead financial institutions, driven by the profit motive, to prioritize algorithmic efficiency over fairness, which may overlook ethical considerations. Finally, the inherent opacity of some AI models may obfuscate the rationale behind decisions, leading to potentially unethical outcomes that are neither transparent to end-users nor fully understood by the institutions deploying them.

4. Countermeasures and Suggestions for the Rational Use of Artificial Intelligence in the Financial Field

4.1. Balancing Artificial Intelligence with Transparency and Accountability

Given the high risks and small margins of error in the financial sector, there is an urgent need to develop ways to "unlock" these black boxes or to establish rigorous safeguards and oversight mechanisms. Balancing the potential of artificial intelligence with the need for transparency and accountability remains a key challenge for the future of finance. The "black box" nature of many AI models, where the decision-making process is not easily explained, poses a significant risk to the financial sector. To counter this, there is an urgent need to develop and adopt more transparent algorithms. Financial institutions should prioritize models that, while complex, provide greater insight into how conclusions are reached. This not only promotes regulatory compliance, but also builds trust with customers and stakeholders. Additionally, tools such as Locally Interpretable Model Agnostic Interpretation (LIME) or SHapley Additive Prediction (SHAP) can be used to gain insight into the specific decisions made by complex models [8]. Ensuring algorithmic transparency will help avoid potential missteps and ensure seamless integration of AI into the financial sector.

4.2. Robust Regulatory Frameworks and Ongoing Audits

As AI rapidly reshapes the financial industry, regulators need to evolve in tandem. A dynamic, AI-specific regulatory framework is critical to ensure that financial institutions responsibly utilize the potential of AI. Such a framework should provide clear guidelines on data privacy, model transparency and ethical considerations. Establish a research group specializing in AI and other financial technologies to further promote the integration of AI and the financial industry while building a professional management system. Additionally, ongoing monitoring and auditing of AI models, especially those that adapt over time, becomes critical. Regular third-party audits can provide an unbiased assessment of AI operations, ensure compliance, and flag potential ethical or operational issues before they escalate. Finally, legislatures should also improve AI-related laws and regulations to avoid a disconnect between AI development and legal regulation.

4.3. Data Integrity and Quality Assurance

At the heart of effective and ethical deployment of AI in finance is data quality assurance. AI models rely heavily on their training data: the phrase "garbage in, garbage out" emphasizes that models built on flawed or incomplete data are prone to producing erroneous or biased results. Financial institutions should implement rigorous data quality checks and validation procedures. Regular data audits can reduce the likelihood of model drift due to outdated or unrepresentative data by ensuring that information is current and accurate. By prioritizing data integrity, financial institutions can improve the reliability of their AI-driven processes and ensure that outputs truly reflect current market conditions, demographics, etc. In addition, breaking through the barriers of data restrictions, breaking the monopoly of the data market, and allowing data to be liberalized and amplified is the best way to make financial markets stable.

5. Conclusion

The convergence of Artificial Intelligence and the financial sector heralds an era of extraordinary potential, driving increased efficiency, precision, and innovation. At this stage, the gap between AI and financial regulation, the opacity of algorithmic processing and the bias it creates make the technology not accurate and reliable. This paper summarizes the development history of artificial intelligence and the general status quo of its application in the financial field, focuses on analyzing the risks and challenges in the application of artificial intelligence in the financial field, and puts forward corresponding countermeasures and suggestions. In conclusion, as the financial industry stands on the cusp of AI-driven transformation, its mark of success in navigating the field will be to strike a balance between embracing the immense capabilities of AI and maintaining the trust that the industry has built. By deploying AI through collaborative efforts, rigorous oversight, and high-quality data, the financial community can capitalize on the power of AI to allow fintech to lead the transformation of the industry. This paper has not yet gone into depth on the specific aspects of AI in the financial sector. In the future, it can be more focused on how AI specifically affects the financial sector, and it can also be divided into regions for specific research.

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