Finance Applications of Artificial Intelligence: Innovations, Challenges, and Future Directions

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ABSTRACT

This article examines the transformative role of Artificial Intelligence (AI) in the financial sector, highlighting how technologies such as machine learning, deep learning, and reinforcement learning are enhancing key functions including fraud detection, credit risk evaluation, and algorithmic trading. The article explores the integration of AI with innovations like robo-advisors, blockchain, and federated learning, emphasizing the superior performance of these systems in managing complex, unstructured data. However, it also addresses critical concerns around explainability, fairness, and data privacy, noting that as AI systems grow more complex, their decision-making processes become less transparent. To mitigate these risks, the chapter discusses emerging approaches such as Responsible AI frameworks, interpretable models, and tools like SHAP and LIME. It concludes by underscoring the need for financial institutions to balance innovation with accountability, ensuring that AI-driven systems are not only efficient but also ethical and inclusive.

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INTRODUCTION

Before too long, artificial intelligence (AI) begins to revolutionize how the banking sector operates. With machine learning (ML), deep learning (DL), and natural language processing (NLP) becoming more sophisticated, AI has become a key component of much of it, ranging from trade software and credit checks to detecting scams and ensuring compliance with rules (Buchanan, 2019; Cao, 2024; Liu, 2024). The application of artificial intelligence in the banking sector is not a passing phenomenon; indeed, it is developing rapidly. It is reported that more than 70% of the world's biggest banks are already applying AI to their daily business. Indeed, the BIS approximates that the world spent $17.3 billion on AI-driven financial products in 2023.

Whether it qualifies as “FinTech” or not, this shift has certainly made it faster, more precise, and more accessible. AI is behind it all, from DeFi sites that allow financial services to be easier to access to robo-advisors that provide investors with tailored advice (Lam, 2025; Buchanan, 2019).

Large, messy data sets with complicated patterns are better served by artificial intelligence than by typical rule-based systems. This allows decisions to be taken in real time and tasks to be automated. ArXiv, 2021; MDPI, 2025: AI has reduced the number of loan failures by 33%, the number of fraudulent alerts by 66%, and the time to complete trades by as much as 75%. But it's not all about the front end.

Artificial intelligence is transforming how money is handled too. RegTech and SuppTech are getting more intelligent due to AI-driven solutions that facilitate easier automatic monitoring of activities, issues, and even smart contracts that should be audited (Lam, 2025; Arner et al., 2017). With the increasingly complex financial landscape, these solutions provide a more proactive and data-centric method of handling compliance, which is becoming increasingly vital. But there are some issues with all of these new concepts. More and more, AI systems become difficult to comprehend and more complex.

Many of these models are “black boxes,” which makes it extremely difficult to determine whether the methods are equitable. Who controls things if things go awry? And even so, can we trust a model that we cannot understand? These problems are highly significant in finance, where control and trust are required (Buchanan, 2019; IMF, 202<). To address these issues, new frameworks are starting to emerge. Concepts such as Responsible Financial AI are being discussed more, as well as techniques for explainable artificial intelligence (XAI) such as SHAP and LIME which attempt to make decisions more transparent. Increasingly, individuals are interested in embedding control systems on platforms, particularly in domains which are highly dynamic, such as DeFi and AI-backed loans. This essay discusses where we are currently with artificial intelligence in finance. It does so by examining four primary areas: the situation and developments as it stands; the impact that it has upon actual people; the dangers and legal issues that we are currently facing; and where we may be heading next. It is the hope to achieve balance between supporting novel ideas and maintaining security, justice, and trust from the public.

Despite substantial academic and industry attention to AI in finance, most studies either focus on isolated technical performance metrics or on conceptual discussions of ethical and regulatory concerns. Few integrate both perspectives through a rigorous mixed-methods approach that connects quantitative model evaluations with qualitative, real-world institutional experiences. This gap limits the ability of stakeholders to translate technical advances into actionable policy and strategy.