EthAIca. 2025; 4:437
doi: 10.56294/ai2025437

ORIGINAL

Artificial Intelligence for Fraud Detection and Portfolio Optimization: Insights from UK Financial Institutions

Inteligencia Artificial para la Detección de Fraudes y la Optimización de Carteras: Perspectivas de las Instituciones Financieras del Reino Unido

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Cite as: Olatunbosun IE, Olatunbosun AR. Artificial Intelligence for Fraud Detection and Portfolio Optimization: Insights from UK Financial Institutions. EthAIca. 2025; 4:437. https://doi.org/10.56294/ai2025437

Submitted: 14-07-2025 **Revised:** 21-09-2025 **Accepted:** 30-11-2025 **Published:** 01-12-2025

Editor: PhD. Rubén González Vallejo

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ABSTRACT

Introduction: artificial intelligence has become an essential tool in modern financial services, particularly in the areas of fraud detection and investment management. Increasing financial crimes and the growing complexity of market environments have created a need for advanced technological solutions capable of supporting more accurate and timely decision-making in financial institutions.
Objective: this study examines the role of artificial intelligence in enhancing fraud detection and portfolio optimization within financial institutions in the United Kingdom.
Method: a quantitative, observational survey was conducted among one hundred and fifty banking professionals from five major financial institutions. The data collection instrument was developed by the researchers using information derived from twenty peer-reviewed academic sources and industry publications. Data were analysed using descriptive statistics to identify general patterns and tendencies in respondents' perceptions.
Results: the results show that artificial intelligence contributes meaningfully to strengthening fraud prevention mechanisms and improving investment management processes, particularly through enhanced analytical capacity and improved risk interpretation.
Conclusion: the study further demonstrates that artificial intelligence supports more secure, efficient, and responsive financial operations, indicating its relevance for the future of financial services in the United Kingdom.

Keywords: Artificial Intelligence; Fraud Detection; Portfolio Optimization; Financial Institutions; United Kingdom.

RESUMEN

Introducción: la inteligencia artificial se ha convertido en una herramienta esencial en los servicios financieros modernos, especialmente en las áreas de detección de fraudes y gestión de inversiones. El aumento de los delitos financieros y la creciente complejidad de los entornos de mercado han generado la necesidad de soluciones tecnológicas avanzadas capaces de apoyar decisiones más precisas y oportunas dentro de las instituciones financieras.
Objetivo: este estudio examina el papel de la inteligencia artificial en el fortalecimiento de la detección de fraudes y la optimización de carteras en las instituciones financieras del Reino Unido.
Método: se realizó una encuesta cuantitativa y observacional entre ciento cincuenta profesionales bancarios pertenecientes a cinco importantes instituciones financieras. El instrumento de recolección de datos fue elaborado por los investigadores utilizando información derivada de veinte fuentes académicas revisadas por

pares y publicaciones del sector. Los datos se analizaron mediante estadísticas descriptivas para identificar patrones generales y tendencias en las percepciones de los participantes.
Resultados: los resultados muestran que la inteligencia artificial contribuye de manera significativa al fortalecimiento de los mecanismos de prevención del fraude y a la mejora de los procesos de gestión de inversiones, especialmente a través de una mayor capacidad analítica y una mejor interpretación del riesgo.
Conclusión: el estudio demuestra además que la inteligencia artificial favorece operaciones financieras más seguras, eficientes y receptivas, lo que indica su relevancia para el futuro de los servicios financieros en el Reino Unido.

Palabras clave: Inteligencia Artificial; Detección de Fraudes; Optimización de Carteras; Instituciones Financieras; Reino Unido.

INTRODUCTION

Financial fraud remains one of the most persistent threats to the stability of the financial system, and digital transformation has expanded both criminals' opportunities and the scale of potential losses.[1] In the United Kingdom, authorised and unauthorised fraud together caused losses in excess of £1,2 billion in 2022, while attempted and reported incidents numbered in the millions, demonstrating the continuing scale and complexity of the problema.[2]

Historically, fraud detection relied primarily on rule-based approaches that encoded expert knowledge into static rules and thresholds. Those methods were effective against well-known schemes but they struggled to adapt to increasingly sophisticated, adaptive attacks and generated many false positives. Research in data mining and machine learning over the last two decades documented the limits of rule-based systems and proposed learning-based alternatives able to detect subtle, evolving patterns.[3] As financial systems digitised, detection moved from post-hoc, manual review toward automated, model-driven screening that can process large streams of transactions in near real time.[4,3,5]

Since the mid-2010s, Artificial Intelligence (AI) techniques, including supervised and unsupervised machine learning, anomaly detection, and neural networks, have been adopted to address these shortcomings.[6] In the UK and globally, banks and fintech firms apply AI to identify behavioural anomalies, correlate disparate data signals, and reduce false positives, thereby improving both speed and precision of detection. Major UK banks have publicly documented AI deployments for fraud analytics and anomaly detection, illustrating industry practice and the operational shift toward data-driven security.[7,8]

Adoption of AI in UK financial services has grown rapidly. Recent regulatory and central bank surveys indicate that a substantial majority of UK financial firms now use some form of AI or machine learning in their operations.[9] A joint survey by the Bank of England and the Financial Conduct Authority (BoE/FCA) reported broad AI deployment across the sector, with three-quarters of respondent firms already using AI and many more planning to do so in the near term. This trend reflects the sector's appetite for scalable, model-driven tools in risk management, compliance, customer service, and fraud prevention.[10,11,12,13]

Beyond fraud detection, AI has reshaped portfolio management and asset allocation. Traditional portfolio management relied heavily on historical analysis and human judgement, which are often slow to respond to sudden market changes. AI-driven portfolio tools can process high-frequency market data, model complex non-linear relationships, and generate optimized allocations under different risk scenarios. These capabilities support more dynamic rebalancing, quantitative risk control, and personalized investment strategies.[4,8]

Despite these advantages, AI systems raise important concerns. Algorithmic opacity, dataset bias, data privacy, and regulatory compliance pose practical and ethical challenges to deployment. Opaque or poorly validated models can produce unfair or unreliable outputs; poor data governance can produce privacy breaches; and regulators increasingly require transparency and explainability for automated decisions. These concerns mean that institutions must balance automation with oversight, testing, and governance to maintain trust and comply with regulations such as the UK Data Protection Act and GDPR.[7,14,15]

Given the increasing incidence of financial fraud, the growing complexity of investment environments, and the strategic shift toward intelligent financial technologies, this study is important for understanding how AI contributes to both fraud detection and portfolio optimization in the United Kingdom. The objective of this study is to examine the impact of Artificial Intelligence on fraud detection and portfolio optimization among financial institutions in the United Kingdom.

METHOD

Type of Study

This research employed a quantitative, observational, cross-sectional survey design to examine the impact

of Artificial Intelligence (AI) on fraud detection and portfolio optimization in financial institutions in the United Kingdom. The study is observational because the researchers did not manipulate any variables; instead, they collected data on naturally occurring perceptions and experiences of banking professionals. A cross-sectional design was appropriate because the objective required capturing the views of respondents at a single point in time, reflecting existing institutional practices and attitudes toward AI integration. This design also supports statistical analysis of relationships among the study variables and aligns with the objective of assessing current operational realities in the UK financial sector.[16,17]

Universe and Sample

The universe of the study consisted of professional bankers working in UK financial institutions that use AI technologies in fraud detection, risk management, and portfolio operations. Five major institutions, Barclays Bank, Halifax Bank, Lloyds Bank, Nationwide Building Society, and NatWest Bank, formed the institutional base for sampling. These institutions were selected purposively because they have publicly adopted AI-driven systems and represent a significant proportion of the UK banking sector in terms of customer base, technological investment, and regulatory importance.

The sample comprised 150 professional bankers drawn from the five selected institutions. A simple random sampling approach was applied within each institution to ensure adequate representation of employees from risk management, compliance, data analytics, operations, and customer service units. Thirty respondents were selected from each institution. The inclusion criteria required that participants must (a) be full-time employees, (b) work in a department involved in fraud prevention, risk assessment, or investment processes, and (c) have at least one year of experience using or interacting with AI-supported tools or systems. Staff who did not meet these criteria were excluded.

Variables

The study included two major constructs aligned with the research objectives. The independent variable was the use of Artificial Intelligence within financial institutions. The dependent variables were fraud detection effectiveness and portfolio optimization efficiency. Fraud detection effectiveness reflected the extent to which AI systems assist in anomaly recognition, reduction of false positives, behavioural pattern analysis, and real-time alert generation. Portfolio optimization captured AI's role in asset allocation, risk modelling, performance analysis, and personalized investment recommendations. All variables were operationalized through questionnaire items measured on a five-point Likert scale.

Data Collection and Processing

Data were collected using a structured questionnaire developed specifically for this study. The questionnaire was created by the authors after a comprehensive review of the literature on AI applications in fraud detection and financial risk management.[3,9,13] Items were designed to measure respondents' perceptions of AI's contribution to fraud detection, risk monitoring, investment analysis, and decision-making processes. The instrument contained closed-ended questions measured on a four-point Likert scale ranging from 1 (Strongly Disagree) to 4 (Strongly Agree), enabling precise quantification of attitudes and experiences.

A validation process preceded full deployment. Three experts in banking technology, financial risk management, and research methodology reviewed the draft instrument to assess clarity, content relevance, and construct representation. Their recommendations led to revisions that improved the logical structure and suitability of the questionnaire. A pilot test was conducted with 10 banking professionals who were not part of the final sample. Their responses were used to calculate Cronbach's alpha, which confirmed acceptable internal consistency and reliability of the instrument.

The final questionnaire was administered electronically through Google Forms. Respondents received a secure survey link and an introductory statement explaining the purpose of the study, confidentiality assurances, and participation rights. The survey remained open for two weeks, and respondents were reminded through follow-up emails to enhance the response rate. Completed questionnaires were downloaded, coded, and cleaned before statistical analysis.

Data processing involved descriptive statistics, including frequencies, percentages, means, and standard deviations, which were used to answer the research questions.[18] These procedures enabled summarisation of trends in respondents' perceptions and provided a basis for interpreting AI's operational contributions within financial institutions.

Ethical Standards

The study complied with established research ethics principles. Approval was obtained under the ethical guidelines of the University of Derby. Participation was entirely voluntary, and respondents were informed that they could withdraw at any time. No identifying information about individuals or institutions was collected,

ensuring anonymity and confidentiality. All data were stored securely and used strictly for academic purposes. Compliance with the UK Data Protection Act (2018) and the General Data Protection Regulation (GDPR) was maintained throughout the research process. Additionally, all secondary materials and scholarly sources used during instrument development and reporting were properly acknowledged to uphold academic integrity.

RESULTS

A total of one hundred fifty (150) questionnaires were distributed, but one hundred thirty-eight (138) were submitted.

Impact of Artificial Intelligence on Fraud Detection and Prevention

Table 1 presents respondents' perceptions of the impact of AI on fraud detection and prevention in financial institutions in the UK. The mean scores across all items range from 3,66 to 4,30, indicating a generally high level of agreement among respondents. Moderately high mean values were also observed for statements indicating that AI can analyze customer behavior to establish normal activity patterns (Mean = 3,90) and that AI helps reduce false positives in fraud detection (Mean = 3,70).

Table 1. Impact of artificial intelligence on fraud detection and prevention among financial institutions in the UK

S/N	Question	SA	A	N	D	SD	Mean	Standard Deviation
1	AI algorithms can analyze large datasets and identify subtle patterns that may indicate fraudulent activity.	90	20	2	12	14	4,16	1,38
2	AI can analyze customer behavior and transaction history to establish a baseline of "normal" activity.	70	30	6	18	14	3,90	1,41
3	AI-driven fraud detection systems can automatically generate alerts and, in some cases, take immediate actions to prevent or mitigate fraud.	80	40	1	13	4	4,30	1,07
4	AI helps in reducing false positives by better distinguishing between legitimate transactions and potentially fraudulent ones.	40	60	4	24	10	3,70	1,25
5	AI models excel at anomaly detection, which is crucial for identifying new and previously unseen forms of fraud.	50	40	8	31	9	3,66	1,34
6	AI can analyze customer behavior and transaction history to establish a baseline of "normal" activity (duplicate).	70	30	6	18	14	3,90	1,41

Impact of Artificial Intelligence on Portfolio Optimization

Table 2 shows the responses of participants regarding the impact of Artificial Intelligence on portfolio optimization among financial institutions in the United Kingdom. The mean scores range from 3,11 to 4,36, reflecting a positive perception of AI's role in optimizing investment portfolios. The highest mean score (Mean = 4,36) corresponds to the statement that AI can perform complex quantitative analyses, evaluating a wide range of factors to optimize portfolio performance. Other statements, such as AI-driven portfolio optimization helping to minimize trading costs and expenses (Mean = 3,88) and AI-driven algorithms optimizing asset allocation based on risk tolerance and market conditions (Mean = 3,86), received high ratings. These results imply that AI is perceived to enhance efficiency and cost-effectiveness in portfolio management while ensuring decisions align with institutional goals and market realities. The statement that AI enables personalized investment portfolios tailored to investor goals also recorded a high mean (Mean = 3,94). However, the lowest mean score (Mean = 3,11) was observed for the statement that AI systems can continuously analyze market data for real-time portfolio adjustments.

Table 2. Impact of Artificial Intelligence on Portfolio Optimization

S/N	Question	SA	A	N	D	SD	Mean	Standard Deviation
1	AI-driven algorithms can optimize asset allocation based on various factors, including risk tolerance, investment goals, and market conditions.	70	30	2	20	16	3,86	1,46
2	AI systems can continuously analyze market data and news sources in real-time, allowing for immediate portfolio adjustments in response to market events.	40	30	6	29	33	3,11	1,59
3	AI enables the creation of personalized investment portfolios tailored to individual investors' goals and risk profiles.	80	20	4	18	16	3,94	1,47

4	AI can perform complex quantitative analyses, evaluating a wide range of factors to optimize portfolio performance.	90	30	2	10	6	4,36	1,10
5	AI-driven portfolio optimization can help minimize trading costs, taxes, and other expenses associated with portfolio management.	60	40	8	22	8	3,88	1,28
6	AI enables financial institutions to better understand and manage the risks associated with investment portfolios.	80	30	4	14	10	4,13	1,28

DISCUSSION

The findings of this study provide empirical evidence that Artificial Intelligence (AI) plays a transformative role in enhancing fraud detection and portfolio optimization among financial institutions in the United Kingdom. The responses from participants indicate that AI technologies are now central to fraud prevention strategies and investment management processes. Regarding fraud detection and prevention, the findings reveal that financial institutions view AI as an essential tool for identifying complex patterns in large datasets, generating real-time alerts, and reducing false positives in fraud analysis. This supports the argument by Chen et al.[8] that AI-based fraud detection represents a paradigm shift from reactive to proactive risk mitigation. Similarly, Phua et al.[3] emphasized that AI systems enhance fraud detection by recognizing hidden patterns that traditional models fail to capture, a view reinforced by the present study's finding that AI systems improve the accuracy of detecting suspicious activities. The results also align with the assertion of Aziz et al.[5] that machine learning models in finance significantly improve the reliability of fraud identification through predictive analytics and anomaly detection. Moreover, the finding that AI enhances behavioral analysis of customers to establish normal transaction baselines agrees with La Torre et al.[13] who noted that AI's capacity for supervised and unsupervised learning facilitates precise differentiation between legitimate and suspicious transactions. Furthermore, the study corroborates the findings of Olatunbosun et al.[6], who reported that financial institutions in the UK increasingly adopt AI-powered fraud detection systems. The present results confirm that AI not only improves fraud detection efficiency but also reduces human error and response delays. This observation also echoes Dwivedi et al.[10] who noted that AI's adaptive and dynamic nature enhances institutional protection against evolving cyber-enabled financial crimes.

In the context of portfolio optimization, the findings demonstrate that AI enhances asset allocation, investment analysis, and risk management among financial institutions. Respondents agreed that AI facilitates complex quantitative analyses that improve portfolio performance, which aligns with Jones et al.[4], who argued that AI-driven algorithms enable the evaluation of real-time market data and behavioral factors to optimize investment outcomes. Likewise, Chen et al.[8] observed that AI enhances decision-making by providing predictive insights that help financial managers respond promptly to market fluctuations. The findings further support Brown et al.[14] assertion that AI-enabled portfolio management fosters agility and data-driven decisions through continuous monitoring and scenario analysis. Additionally, the study affirms the argument by Johnson[12] that the UK financial sector leverages AI not only for operational efficiency but also for strategic investment planning. The findings also validate the study of Olatunbosun et al.[6] Similarly, Cruz[11] posited that AI minimizes portfolio risks and associated costs by optimizing asset allocation and transaction timing. However, the indication that AI systems may face constraints in real-time data analysis slightly diverges from Brown et al.[14] position that AI fully supports instant decision-making in volatile markets. This suggests that while AI adoption in UK financial institutions is advanced, there may still be infrastructural or operational barriers limiting full real-time optimization.

CONCLUSIONS

This study set out to examine the impact of Artificial Intelligence on fraud detection and portfolio optimization within financial institutions in the United Kingdom. The findings of the research demonstrate that AI has become an integral component of modern financial operations, supporting institutions in enhancing security, improving decision-making, and strengthening investment management practices. The study affirms that AI provides substantial value to fraud detection by enabling institutions to move beyond traditional rule-based approaches and adopt more adaptive, data-driven security frameworks. Through its analytical and predictive capabilities, AI contributes to more efficient oversight, faster identification of irregularities, and more strategic prevention mechanisms. These contributions highlight AI's broader role in reinforcing the resilience of financial systems and its potential to support institutions as fraud schemes evolve in complexity.

In relation to portfolio optimization, the study concludes that AI facilitates a shift toward more sophisticated investment management environments. Its capacity to process complex datasets, model risk exposure, and support dynamic asset allocation contributes to more informed and responsive portfolio strategies. AI, therefore, serves as a strategic tool that enhances institutional ability to navigate volatile markets, tailor investment decisions, and optimize long-term performance. Generally, the study establishes that the integration of AI into fraud detection and portfolio optimization reflects a broader transition toward intelligent financial technologies

in the UK banking sector. While challenges concerning transparency, data governance, and ethical considerations remain, the general conclusion is that AI strengthens institutional capabilities and offers a foundation for more secure, efficient, and forward-looking financial services. Continued investment, responsible deployment, and improved regulatory alignment will therefore be essential for maximizing the long-term benefits of AI within the financial industry.

Based on the findings of this study, the following recommendations have been formulated:

1. Financial institutions should deepen their investment in AI-powered fraud detection and portfolio management systems. Beyond adoption, there should be a stronger focus on integrating real-time data analytics capabilities to enable instant responses to fraudulent activities and dynamic market shifts. Institutions should also enhance their internal capacity by training staff to effectively interpret and utilize AI-driven insights in decision-making processes.
2. Regulatory bodies should establish clear frameworks and standards for the ethical deployment of AI in financial services. This includes ensuring transparency, data privacy, accountability, and fairness in AI systems. Regulatory support for innovation, such as sandbox environments, can encourage responsible experimentation and scaling of AI solutions.
3. Universities and research institutions should conduct more applied research on the integration of AI in financial systems, focusing on local and international best practices. Collaborative research between academia and industry can generate context-specific solutions that address operational gaps in real-time fraud detection and portfolio optimization.

However, this study is limited in several ways. First, it focused on selected financial institutions in the United Kingdom, which may restrict the generalizability of the findings to other institutions or regions. Second, the use of a purely quantitative approach may not fully capture the nuanced experiences and implementation challenges associated with AI in fraud detection and portfolio optimization. Third, the study concentrated on the perspectives of financial institution employees, excluding other key stakeholders such as policymakers, technology developers, investors, and customers. Finally, the research examined only two areas of AI application without considering other critical financial functions.

Future studies should expand the scope to include more institutions across different regions and adopt a mixed-methods approach for richer insights. Incorporating multiple stakeholder perspectives would provide a more holistic understanding of AI's impact. Further research should also explore additional areas of AI application, such as credit risk assessment, compliance, and customer service, to offer a broader view of its role in financial services.

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FINANCING

The authors did not receive financing for the development of this research.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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