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## THE ROLE OF AI IN FINANCIAL RISK MANAGEMENT AND FRAUD DETECTION

**Abstract:** This article examines the role of Artificial Intelligence (AI) in financial risk management and fraud detection. Traditional methods and AI methods, such as Machine Learning (ML), neural networks, and natural language processing (NLP), are compared in their ability to process large volumes of data, identify complex patterns, and adapt to market changes. The successful application of AI in the financial sector is highlighted using examples from companies like Deloitte and PwC, and ethical and legal challenges are discussed. The results indicate that AI significantly enhances operational efficiency and security in financial institutions.

**Key words:** Artificial Intelligence, machine learning, neural networks, natural language processing, financial risk management, fraud detection, data analysis.

**Language:** English

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### Introduction

Financial risks arising from complex economic conditions and rapidly changing market trends, necessitate new approaches for their assessment and management. Traditional methods of data analysis and forecasting often prove insufficiently effective, underscoring the need for the implementation of innovative technologies.

Artificial Intelligence (AI) offers extensive capabilities for identifying complex patterns. Machine Learning (ML), a crucial technology within AI, is actively utilized to develop models capable of predicting risks and detecting anomalies in financial transactions. ML models are trained on historical data and can adapt to changes, making them particularly valuable in unstable market conditions.

The purpose of this article is to investigate the role of AI in financial risk management and fraud detection. The article explores the primary AI approaches and technologies, their advantages and

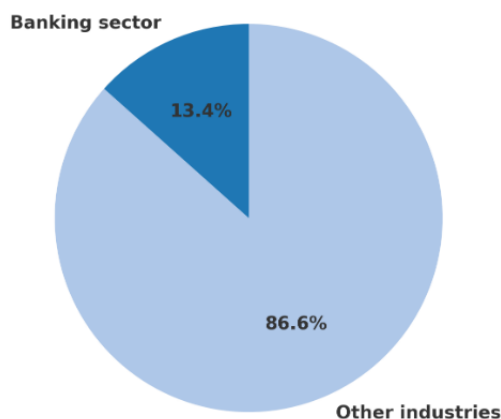
disadvantages, as well as successful examples of AI applications in the financial sector. Additionally, it discusses potential ethical and legal issues associated with AI implementation in finance and considers the prospects for the further development of this technology.

### Main section. Methods of managing financial risks using AI

Artificial Intelligence (AI) has become an integral part of modern financial systems, offering capabilities for analyzing large volumes of data and forecasting future events. The global AI market in fintech was valued at \$42,83 billion USD in 2023 and is projected to reach \$44,08 billion USD in 2024 [1]. Global investments in AI-based systems amounted to approximately \$154 billion USD in 2023. Notably, investments in the banking sector reached \$20,6 billion USD, representing the highest expenditure (fig. 1).

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**Figure 1. Share of AI investments in the global banking sector in 2023 [2]**

AI technologies, such as ML, neural networks, and natural language processing, enable financial institutions to manage risks more effectively and detect fraudulent schemes. An important aspect is the

use of complex algorithms and models for creditworthiness assessment, market fluctuation forecasting, and investment portfolio analysis (table 1).

**Table 1. Methods of managing financial risks using AI [3, 4]**

| AI method                    | Description  | Examples of application                   |
|------------------------------|--|---|
| Machine learning             | Training on historical data for event forecasting            | Creditworthiness assessment, market risk  |
| Neural networks              | Modeling brain function for processing complex data          | Time series forecasting, market analysis  |
| Support vector machine (SVM) | Classification and regression using high-dimensional data    | Risk assessment of stocks and bonds       |
| Ensemble methods             | Combining several models to increase accuracy                | Random forests, gradient boosting         |
| Natural language processing  | Text analysis to identify patterns and predict impacts       | News analysis, social media               |
| Deep learning                | Analyzing complex structures to identify relationships       | Forecasting financial crises              |
| Clustering                   | Segmentation to identify groups with similar characteristics | Assessing risk of various customer groups |
| Sentiment analysis           | Identifying sentiments through text data analysis            | Forecasting changes in market conditions  |

According to the author, the use of AI in financial risk management opens new horizons for data analysis and interpretation. Companies can respond more quickly to changes in market conditions and identify potential threats at early stages. Successful utilization of AI in the financial sector requires not only technological infrastructure but also high-quality data and a high degree of model interpretability. Only under these conditions can significant results be achieved, ensuring the safety and reliability of financial operations.

### Fraud detection using AI

Fraud poses a significant threat to financial institutions, leading to substantial losses and

undermining client trust. It can take various forms, including credit fraud, money laundering, data theft, and securities fraud. Phishing, which involves attempts to obtain confidential information by deceiving users through emails or websites posing as trustworthy sources, is another common type. In the first quarter of 2024, over 963,000 unique phishing sites were detected worldwide [5]. Financial institutions accounted for 9,8% of these attacks, ranking third after social media (37,6%) and email (21%).

The introduction of AI technologies has significantly changed approaches to fraud detection in the financial sector, providing more accurate and timely tools for identifying suspicious activities.

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Table 2 presents a comparative analysis of the effectiveness of AI and traditional methods in fraud detection.

**Table 2. Comparative analysis of the effectiveness of AI and traditional methods in fraud detection**

| Criterion                 | Artificial Intelligence (AI)   | Traditional methods  |
|---------------------------|--|--|
| Detection accuracy        | High accuracy due to the analysis of large data volumes and complex patterns | Limited accuracy due to simple rules and manual analysis                   |
| Detection speed           | Fast real-time detection   | Slower detection due to the need for manual intervention                   |
| Adaptability              | Ability to learn and adapt to new fraud schemes                              | Limited adaptability, requiring regular rule updates                       |
| False positives           | Reduced false positives through more precise analysis                        | High rate of false positives   |
| Implementation costs      | High initial costs, but reduced operational costs in the long term           | Low initial costs, but high operational expenses                           |
| Data requirements         | Requires large amounts of quality data                                       | Fewer data requirements, but reduced analysis efficiency                   |
| Decision interpretability | Can be complex, requiring specialized tools to explain decisions             | High interpretability, decisions based on simple rules and manual analysis |
| Scalability efficiency    | High, can analyze large data volumes without losing efficiency               | Low, requires significant resources as data volumes increase               |

AI provides more accurate and adaptive tools for detecting fraud, enabling financial institutions to respond to threats more effectively and reduce financial losses. Traditional methods, while simpler to implement and interpret, fall short of AI in terms of speed and accuracy in detecting fraudulent activities. The integration of AI technologies in the financial sector contributes to the creation of a more secure and resilient system capable of withstanding modern challenges and threats.

**Deloitte**, one of the major global consulting and auditing firms, employs ML and big data analysis technologies to detect fraudulent transactions and anomalous behavior. Specifically, Deloitte utilizes the Deloitte Analytics platform, which integrates various data sources and applies AI algorithms to identify suspicious patterns in financial operations. This enables clients to timely detect and prevent fraudulent activities.

The Converge platform for financial services, developed by Deloitte in collaboration with its international branches, helps clients analyze data in real-time and identify suspicious activity, significantly reducing the risk of crimes. These measures not only prevent financial losses but also strengthen client trust and ensure market stability. In the 2022/2023 financial year, Deloitte's revenue grew by 7,1%, reaching €1,359 million compared to €1,270 million in 2021/2022 [6].

**PwC** (PricewaterhouseCoopers), one of the leading American firms providing audit, tax, and consulting services, also employs AI technologies to protect against fraud, ensuring a high degree of security and reliability in financial operations for its clients.

One of PwC's solutions is the «Halo for Journals» platform, which uses ML and big data analysis to monitor and analyze accounting records. This helps detect anomalous transactions and potential cases of fraud by analyzing vast amounts of data in real-time.

PwC also applies NLP technologies for text data analysis. For instance, when analyzing correspondence and reports, algorithms can detect signs of fraudulent intentions or actions, allowing potential threats to be prevented. Modern AI-based methods are used to support monitoring and testing in internal audit areas such as [7]:

- Utilizing greater volumes of quantitative analytics and pattern analysis to assess risks and prioritize audit organization.
- Pattern analysis in business unit-related issues.
- Using data for more in-depth testing control in areas like anti-money laundering (AML), capital analysis, and financial reporting.

PwC actively integrates AI-based solutions into its auditing and consulting services, providing clients

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with high protection against financial crimes and enhancing overall operational reliability.

**The impact of AI on the financial industry**

Modern technologies based on AI have a profound impact on the financial industry, transforming operational processes and decision-making mechanisms [8]. The implementation of AI

significantly automates routine tasks, improves the quality and accuracy of data analysis, and enhances the efficiency of risk management and fraud detection. ML algorithms, big data analysis, and NLP provide more accurate and timely decisions, contributing to the reduction of operational costs and the increased competitiveness of financial organizations (table 3).

**Table 3. Impact of AI on operational processes and decision-making in the financial industry [9, 10]**

| Aspect                 | Impact of AI   |
|------------------------|--|
| Transaction processing | Automation and increased speed of data processing                    |
| Risk management        | Accurate risk forecasting and assessment using ML                    |
| Fraud detection        | Rapid detection of anomalies and suspicious transactions             |
| Data analysis          | Improved quality of analysis using big data and deep learning        |
| Decision-making        | Support and optimization of strategic and tactical decisions         |
| Customer service       | Personalization of services through chatbots and intelligent systems |
| Regulatory compliance  | Ensuring compliance through automated monitoring and reporting       |
| Financial reporting    | Improved accuracy and transparency of financial reporting            |

According to the author, the ethical and legal aspects of AI use in the financial sector require special attention due to the necessity of ensuring fairness, transparency, and the protection of consumer rights. AI algorithms must be designed and implemented in a way that avoids discrimination and bias, which can arise from data errors or improper model settings. It is important for clients and regulators to understand and monitor AI decision-making processes, necessitating the development of transparency and accountability standards [11].

The use of AI in the financial sector must strictly comply with legal requirements for data protection and privacy. Financial institutions are obligated to ensure that clients' personal data is protected from unauthorized access and use [12]. This requires the constant updating and improvement of security systems, as well as the implementation of robust monitoring and auditing mechanisms. Regulators, in turn, must develop and enforce regulations that ensure compliance with these requirements and adapt to rapid technological changes [13].

One of the key **technical features** of AI implementation in the financial industry is the necessity for high-quality data to train AI models. Incomplete or incorrect data can lead to inaccurate conclusions and biases in algorithms. Significant computational power and specialized knowledge are also required to develop and maintain such systems, which can be a considerable barrier for financial institutions, especially smaller companies.

**Organizational challenges** include resistance to change from employees and the need for ongoing training and skill enhancement. AI implementation necessitates the revision of existing business

processes and structures, which can provoke resistance and require substantial change management efforts. **Economic aspects** also play a crucial role, as the initial investments in AI development and implementation can be quite substantial. Moreover, there is uncertainty regarding the return on these investments, which may deter decision-making on AI adoption in the financial sector.

The future of AI in the financial sector promises significant changes and improvements, especially in risk management and fraud detection. Advances in deep learning and neural network technologies will enable the creation of more complex and accurate models for risk prediction and fraud detection. Real-time AI implementation will help financial institutions respond promptly to threats and prevent losses, enhancing the resilience and stability of financial systems. Additionally, using AI to analyze customer behavior and market trends will improve strategic planning and asset management.

Integrating AI with other advanced technologies, such as blockchain and quantum computing, will open new horizons for ensuring the security and transparency of financial transactions. Such innovations will help create more efficient and secure financial ecosystems capable of countering cyber threats and fraudulent activities. In the long term, the application of AI may become standard practice in the financial sector, leading to improved customer service quality, reduced operational costs, and the creation of new opportunities for business growth and development.

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### Conclusions

Enhancing the management of financial risks and detecting fraudulent activities within the financial sector significantly benefits from AI. Technologies within AI, particularly ML, neural networks, and NLP, have transformed traditional methods by offering advanced tools for data analysis, anomaly detection, and predictive modeling. These technologies enable financial institutions to handle large volumes of data, identify complex patterns, and adapt to changing market conditions more effectively than conventional methods. For instance, ML models trained on historical data can forecast potential risks and identify unusual transaction patterns. Furthermore, AI's ability to process and analyze real-

time data supports quicker responses to emerging threats, reducing the likelihood of financial losses and enhancing overall operational stability.

The integration of AI in financial risk management and fraud detection also brings about significant operational benefits. Leading consulting firms like Deloitte and PwC have successfully implemented AI-based platforms to monitor financial transactions and detect fraud in real time, significantly reducing the incidence of financial crimes and increasing client trust. The successful deployment of AI requires robust data infrastructure, high-quality data, and the continuous enhancement of algorithms to maintain their effectiveness and reliability in dynamic financial environments.

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