



Application of Artificial Intelligence in Enterprise Risk Management Systems

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Abstract. Artificial intelligence, as the core driving force of the new round of technological revolution, promotes high-quality economic development by empowering industrial upgrading and cultivating new quality productivity. At the same time, it enhances people's livelihoods in fields such as healthcare and education, becoming a strategic high ground for international competition. With technology developing rapidly, artificial intelligence (AI) has become an important force in promoting the innovation in enterprises management. Especially in the risk management field, the application of AI technology has provided more and more effective solutions and essential support for the enterprises to operate stably. This paper has pointed out the existing application of AI in risk management systems, identified the areas in which AI has been applied and the challenges it will face in the future. The research results show that AI has been effectively applied in plenty of areas, but there are still directions for broadening its application. This study has not only provided an overview of the application of AI in risk management systems but also offered new perspectives for future research and application directions.

Keywords: Artificial Intelligence, Enterprise Risk Management System, Application Status, Research Expansion.

1 Introduction

Enterprise Risk Management (ERM) system is a process that aims to reduce the impact of uncertainty on enterprises by identifying, assessing, responding to, and monitoring various factors that may affect the achievement of corporate objectives.

The core of ERM is to balance opportunities and threats in business operations and to ensure the stability of the organization in a complex and changing environment. In the 'One Axis, Five Rings' conceptual framework for ERM systems developed by COSO, the leading organization dedicated to providing guidance on internal control, enterprise risk management and fraud prevention, the axes of an ERM system are: corporate mission and core values, strategic development, business objectives, implementation and performance; and the five elements are: governance and culture, strategy and objective setting, performance, communication and reporting [1].

COSO emphasizes that ERM permeates almost all of the activities in the whole enterprise, and the structure of 'one axis, five rings' of ERM system integrates the strategic development and risk management of the enterprise closely, through the leadership of governance and culture, the clarity of strategy and objectives, the guarantee of performance, the continuous improvement of review and revision, and the effective support of information communication and reporting. It helps the enterprise to achieve sustainable development in the complex and changing environment through the leadership of governance and culture, the clarity of strategy and objectives, the guarantee of performance, the continuous improvement of review and revision, and the effective support of information communication and reporting. It is clear that a dynamic, comprehensive and efficient risk management system is an important factor for every enterprise to respond to risks in a timely and appropriate manner, to seize opportunities in development and to minimize the negative impacts of risks. Therefore, an enterprise that can continue to operate in a complex and changing market environment, and even continue to develop and improve itself, must include a complete, mature and efficient ERM system.

And nowadays the rapid development of artificial intelligence has shown a strong potential in various fields. In the enterprise, the introduction of artificial intelligence financial sharing center, human resource management system and so on began to take part of the enterprise operation and management tasks. The multiple elements involved in ERM systems will also be significantly impacted by AI. The complex big data analysis models, real-time monitoring systems, performance evaluation systems, etc. provided by AI can quickly process huge amounts of data to identify potential risks and improve the accuracy of the enterprise's risk assessment; it can also formulate more targeted and specific strategies, and at the same time realize dynamic monitoring and early warning of risks, so as to help the enterprise cope with the risks faster and more efficiently and adapt to the complex and changing market environment.

The introduction of artificial intelligence is also an opportunity for enterprises to improve their ERM systems. The use of artificial intelligence to formulate personalized response plans for risks, continuous monitoring and regular evaluation can help enterprises form a real-time and efficient ERM system. The closed-loop management mechanism can also help enterprises to continuously learn lessons, adjust risk management strategies and optimize management processes. In addition, artificial intelligence can analyze the data in depth and more accurately identify weaknesses and potential problems in risk management. Thus, the proper introduction of AI into the ERM system is a key step for enterprises to improve their risk management process and realize rapid adaptation to the environment and sustainable operation.

However, the application of AI in ERM system nowadays is still not comprehensive enough, although it has been effective in some aspects; at the same time, there are some gaps in the existing research on how AI is applied to risk management. In this situation, this paper summarizes the current research on the application of AI in ERM system, discusses in detail the current research status of AI application in enterprise risk management system from multiple dimensions, summarizes the good aspects of the current application of AI, and also points out the possible challenges and the direction of expanding the research. This paper not only provides an overview of the current status of

the application of AI in ERM systems for enterprises and subsequent research but also provides a reference on how to better utilize AI technology to improve risk management capabilities.

2 Current Applications

2.1 Overall Risk Management Framework

Currently, the application of artificial intelligence in enterprise risk management is mainly reflected in the rapid identification of potential risks by constructing a dynamic risk management system and using real-time data processing and prediction models [2]. For example, ERM models which are based on machine learning can obviously improve the accuracy and efficiency of risk identification [3]. This dynamic risk management framework help enterprises to monitor the change of risk and adjust risk management strategies in time and therefore give a better respond to the complex changing of market environment [4].

2.2 Data Analysis and Modeling Techniques

The main advantage of AI in risk management is its powerful data analysis capabilities. Many studies have shown that companies can find risk signals from text, image, and speech data more effectively by applying technologies such as natural language processing, computer vision, and deep learning [5]. For example, risk predicting models based on recurrent neural networks (RNN) have been successfully utilized in credit risk management in financial industry [6]. These techniques are not only able to handle large-scale structured data, but also able to analyze unstructured data effectively, therefore providing enterprises with more comprehensive risk information.

2.3 System Implementation and Process Optimization

Artificial intelligence-driven risk control systems have been practically applied in a number of industries, markedly improving enterprises' operational efficiency and risk management ability. For example, in the manufacturing industry, artificial intelligence can monitor abnormal data in the production process in real time, then predict the risk of equipment failure in advance [7]. Also, AI plays a main role in supply chain risk management. AI also plays an important role in supply chain risk management. It can improve the stability of the supply chain significantly through predictive maintenance and self-repair functions [8]. This kind of implementation system and process optimization will not only reduce the operation cost but also improve the competitiveness of the enterprise.

2.4 Human-Machine Collaboration Mechanism

Although AI has played an important part in risk management, its application still depends on the decision-making ability and expertise of humans. Studies have shown that combining AI techniques with the human experts' experience can improve the performance of risk management [4]. For example, a human-computer collaboration system based on reinforcement learning performs better than a single AI model or human expert in the selection of risk response strategies [9]. This human-computer collaboration

mechanism can both increase the accuracy of risk management and enrich the adaptability of enterprises in complex environments.

2.5 Real-Time Monitoring and Early Warning

Artificial intelligence has a good performance in real-time monitoring and risk alerts, helping organizations to quickly identify and respond to potential risks. Using deep learning algorithms, enterprises can build real-time monitoring platforms to quickly identify potential risks [9]. For example, a risk control system based on time series analysis can detect financial risks from market fluctuations at an early stage [6]. This real-time monitoring and early warning prediction mechanism not only improves the enterprise's risk response ability, but also reduces the losses caused by risks.

3 Challenges Faced by AI Applications in ERM Systems

Though the application of artificial intelligence in the field of risk management has made some progress, and the related research in several aspects has been initially perfected, with the continuous development of technology and the increasing complexity of enterprise needs, future research still needs to be explored in more aspects of good expansion.

3.1 Generalization of AI Models

Existing AI models are often designed for specific scenarios and lack cross-industry generalization. This limitation mainly stems from the over-reliance on specific datasets and business scenarios during model training, which leads to a significant performance degradation of the model when facing new and unseen data distributions [10]. For example, in complex business scenarios, due to the diversity of user behaviors and the dynamics of data distribution, the test data faced by the model in the deployment phase has a significant distributional offset from the training data, which affects the model's generalization ability. In addition, the complexity of multi-modal data also increases the challenge of model generalization capability. Besides, the alignment and fusion problems between different modal data still have not been totally solved [3].

3.2 Dynamic Adaptability of AI Models

Since the traditional AI models are difficult to update and adjust in the face of rapidly changing external environments, the dynamic adaptability of artificial intelligence is still limited. In the practical applications, the data and risk scenarios that enterprises need to deal with are constantly changing, but the existing AI models often lack of sufficient dynamic adaptability [6]. An example is risk management in financial markets. Market fluctuations and the changes of macroeconomic environment require models to quickly adapt to new data and risk characteristics, but existing models often need to be retrained or adjusted, which will increase the maintenance cost and response time of the model. In addition, continuous learning algorithms may still have negative influence on model performance when dealing with conceptual drift between old and new data [3].

3.3 Data Privacy and Security

In the risk management process, organizations need to handle a large amount of sensitive data. As a result, it can be a challenge for them to ensure the security and compliance of these data. The AI system may have the risk of information leakage in the process of data collection, processing and analysis, and this problem will cause a serious threat to the operation and reputation of enterprises [2]. For example, because of the lack of cross-enterprise and cross-platform data sharing mechanisms, it is easy to generate data silos, leading to outstanding data security and privacy protection issues. And the 'black box' nature of AI models conflicts with the reliability requirements in the market, and the lack of model explainability also increases the difficulty of data security and privacy protection [3].

4 Potential Directions

Artificial intelligence technology can not only improve the efficiency and accuracy of risk management but also provide enterprises with more powerful decision support tools. However, the application of AI in risk management is still in the development stage, and future research can be expanded and deepened in the following aspects.

4.1 Enhancing Generalization and Dynamic Adaptability

In the future, research could explore the following directions to address the issue of insufficient generalization ability in AI models. Firstly, developing multi-modal AI systems which are capable of processing multiple types of data, including text, images, and voice, is one of the solutions. These multi-modal systems can capture risk information more comprehensively and improve the quality of risk identification and assessment. For example, in the manufacturing industry, combining image recognition technology with sensor data can predict equipment failure risks more accurately [10]. Secondly, federated learning technology can also be applied to share and optimize models and protect data privacy at the same time [3]. Federated learning allows different companies or departments to train AI models together without sharing raw data, therefore enhance the model's generalization ability and adaptability. For example, in the financial industry, multiple banks can share risk assessment models through federated learning technology to improve the whole risk management level of the industry.

4.2 Optimizing Human-Machine Collaboration Mechanisms

Although research has already focused on human-machine collaboration, there is still some space for further development. First of all, developing intelligent decision support systems can help human experts deal with risk events more efficiently. For example, risk assessment reports produced by AI algorithms can provide human experts with more comprehensive and accurate information, therefore improve the effectiveness of decision-making [2]. Meanwhile, the human-machine collaboration model based on game theory can also be studied to increase the effectiveness of risk management strategies. The game theory model can imitate the interaction and decision-making process

between humans and machines, along with optimizing the collaboration between the two parties, and thus improve the overall effectiveness of risk management [4].

4.3 Industry-Wide Sharing and Standardization

The application of AI technology in risk management also needs to be promoted and standardized, especially in different industries. Firstly, promoting inter-industry communication and cooperation to establish unified technical standards and data specifications is a considerable idea. Secondly, technology sharing and innovation can also be promoted by applying industry alliances or open-source communities [7]. Open-source communities can provide an open platform for enterprises and research institutions to develop and optimize AI risk management tools jointly and promote the development of technology.

5 Conclusion

This paper provides a comprehensive overview of the current situation of AI's application in ERM systems. The study points out that artificial intelligence technology has shown significant potential in enterprise risk management, especially in risk identification, real-time monitoring, early warning prediction, and system optimization. Through its powerful data analysis capabilities, AI is able to analyze huge amounts of data to identify potential risks and provide enterprises with more suitable risk assessment and response strategies. At the same time, the application of human-computer collaboration mechanisms also improves the efficiency and accuracy of risk management. However, the application of AI in ERM systems still faces many challenges, such as the lack of versatility, the limit of dynamic adaptability in AI models, along with data privacy and security issues. These problems are still influencing the further promotion and utilization of AI in ERM system.

Although this paper provides a more systematic compendium and analysis of the current application of artificial intelligence in ERM systems, it still has several shortcomings. For example, the analysis of specific application cases of AI technology in different industries is not deep enough, and it also does not fully demonstrate the unique advantages and special challenges in specific industries. In addition, for the future direction of expanding the application of AI in ERM system, though a variety of possible research directions are proposed, more specific implementation paths and methods are still lacking. Future research can further deepen the research on the application of AI to provide more targeted guidance and suggestions for enterprise risk management practice.

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