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Article

Application of AI technology in audit risk assessment and control: Taking internal audit of higher education institutions as an example

Xiaofeng Luo[1,*], Xuehe Wang[2], Tao Jiang[2]

[1] Guangdong Industry Polytechnic University, Guangzhou 510000, China
[2] Sun Yat-Sen University, Guangzhou 510275, China
*** Corresponding author:** Xiaofeng Luo, 673484352@qq.com

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Abstract: With the rapid development of artificial intelligence (AI) technology, its application in the field of auditing has gained increasing attention. This paper explores the application of AI technology in audit risk assessment and control (ARAC), aiming to improve audit efficiency and effectiveness. First, the paper introduces the basic concepts of AI technology and its application background in the auditing field. Then, it provides a detailed analysis of the specific applications of AI technology in audit risk assessment and control, including data analysis, risk prediction, automated auditing, continuous monitoring, intelligent decision support, and compliance checks. Finally, the paper discusses the challenges and opportunities of AI technology in audit risk assessment and control, as well as future research directions.

Keywords: artificial intelligence; audit risk assessment; audit control; data analysis; risk prediction

1. Introduction

With the advancement of technology and the advent of the big data era, AI technology has become a focal point across various industries. In the field of auditing, the application of AI technology has also attracted broad attention (Guillaume, 2024; Zheng, 2024). Audit risk assessment and control, as core components of the audit process, are crucial for improving audit quality and efficiency. Therefore, exploring the application of AI technology in ARAC research holds significant theoretical and practical value. AI technology, with its powerful data processing, analysis, and learning capabilities (Inigo, 2023; Ivanov, 2024), can assist auditors in more effectively identifying and assessing risks, thereby enhancing the accuracy and efficiency of audit work (Hainous et al., 2021; Liu et al., 2024). This paper will discuss the following aspects: First, the necessity and importance of strengthening ARAC in higher education institutions; second, the significance of applying AI technology to ARAC in these institutions; and finally, the challenges and opportunities of AI technology in audit risk assessment and control, along with future research directions. This paper aims to provide auditors with a new perspective and approach to address the increasingly complex audit environment and risks, ultimately improving the quality and efficiency of audit work.

2. The necessity and importance of strengthening internal ARAC in higher education institutions

With the rapid development of higher education, internal auditing within universities, as a crucial means to ensure the legality of economic activities and

improve management efficiency, has received increasing attention from all sectors of society. General Secretary Xi (2022), while presiding over the 40th group study session of the Political Bureau, emphasized the need to deepen the understanding of Party conduct and anti-corruption efforts under the new circumstances, and to enhance the capability and effectiveness in integrating the measures that prevent corruption by eliminating the desire, the opportunity, and the incentive to engage in corrupt practices. The goal is to comprehensively win the tough and protracted battle against corruption (Xi, 2022). Promoting the integration of "Three Not Corrupts" within universities cannot rely solely on disciplinary inspection and supervision agencies; it requires strengthening the collaborative governance functions of university auditing departments.

2.1. Relevant concepts of internal auditing in higher education institutions

According to the Regulations on Internal Auditing in the Education System, internal auditing refers to activities where independent, objective supervision, evaluation, and recommendations are provided on the fiscal and financial revenues and expenditures, economic activities, internal control, and risk management of an organization and its affiliated units, to promote the improvement of governance within the organization and the achievement of its goals (Ministry of Education of the People's Republic of China). Specifically, in the context of higher education institutions, internal auditing is a specialized auditing body or personnel established within universities to lawfully examine and evaluate the financial revenues and expenditures, economic activities, and other related matters of the university and its affiliated units. This is done to uphold financial discipline, enhance economic efficiency, and promote the healthy development of the university's endeavors.

Internal auditing in universities is characterized by independence, objectivity, and professionalism. Independence is the essence of internal auditing and is a prerequisite for maintaining objectivity and fairness. Objectivity requires that internal auditors maintain an impartial and unbiased attitude during their work, free from any external interference. Professionalism is reflected in the need for internal auditors to possess specialized auditing knowledge and skills, enabling them to accurately identify and analyze risks and issues within the university's economic activities.

The scope of internal auditing in universities is broad and complex, covering aspects such as income auditing, expenditure auditing, financial budget auditing, and economic responsibility auditing. Income auditing focuses on the compliance of various fee items and the authenticity of receipts; expenditure auditing emphasizes the legality and compliance of fund usage; financial budget auditing supervises the formulation and implementation of the university's budget; and economic responsibility auditing assesses and evaluates the economic responsibility performance of university leaders during their tenure.

Internal auditing in universities plays a constraining and protective role in ensuring the adherence to and execution of financial regulations, while also promoting better management and enhancing efficiency. Through auditing work, internal auditors in universities can uncover problems and risks within the university's economic activities, propose improvement suggestions, and help the university enhance internal

control, prevent economic risks, and improve both economic and social benefits. Internal auditing functions like a healthcare doctor, tasked with "curing diseases if present, preventing them if not", with a focus on warning, rectification, and standardization. By fulfilling its role of "immune system" and acting as a safeguard, internal auditing promotes continuous management improvement within the university, ultimately aiming to maximize value.

2.2. Current issues in risk assessment and control in internal auditing of higher education institutions

As an integral part of the internal governance system in higher education institutions, internal auditing has the responsibility of conducting risk assessment and control. The Internal Audit Practice Guide No.4-Internal Auditing in Higher Education Institutions, issued in 2009, explicitly stated that internal auditing in universities should actively transition from traditional error detection and account auditing to risk-based auditing (China Institute of Internal Audit, 2009). However, in practice, due to various factors, internal auditing in higher education institutions faces several shortcomings in risk assessment and control. Internal auditors conduct risk assessments of the institution's economic activities, determine audit content and focus based on the risk assessment results, and select appropriate audit procedures to enhance audit efficiency and effectiveness.

In terms of risk assessment, some internal auditors in higher education institutions have a weak awareness of risk assessment and lack sufficient understanding of its importance. There is a lack of proactive awareness and motivation to conduct risk assessments, leading to potential risks not being promptly identified and recognized, thereby increasing the economic risks faced by the institution. Currently, there is a shortage of internal auditors in Chinese higher education institutions, with a relatively narrow knowledge structure, particularly in the area of risk assessment and control, where qualified personnel are limited, and overall competency needs improvement (Han, 2018). Additionally, some internal auditing departments in higher education institutions face limitations in their risk assessment methods, lacking scientific and systematic evaluation tools, which may result in inaccurate risk assessment outcomes and an inability to accurately reflect the institution's risk status. Furthermore, internal auditing in higher education institutions often relies on limited information and data during risk assessments. The lack of comprehensive risk assessment information may lead to potential biases in the assessment results.

In terms of risk control, internal auditing in higher education institutions often fails to implement effective risk control measures. Some control measures lack specificity and practicality, making it difficult to effectively prevent and control risks. Additionally, insufficient supervision of risk control by internal auditors results in risk control efforts becoming a mere formality, failing to achieve the desired outcomes. Moreover, in some higher education institutions, there is a disconnect between risk control and business development. Internal auditors face difficulties in balancing the relationship between business development and risk control, making it challenging to

safeguard the institution's economic interests while effectively preventing and controlling risks.

2.3. Strengthening internal ARAC as a crucial safeguard for university development

Internal auditing, as a key element of university governance, plays an important role in promoting and improving governance within higher education institutions (Pavlova, 2020; Zhang et al., 2015). As institutions responsible for cultivating high-level professionals, conducting scientific research, and providing social services, the robust operation and healthy development of higher education institutions have a profound impact on the nation and society. In this context, internal auditing, as a critical component of internal management in universities, is particularly vital for risk assessment and control.

Strengthening internal ARAC in universities ensures the safety and integrity of university assets (Natalja, 2017). Universities possess a vast array of assets, including teaching facilities, research equipment, library resources, and funds. Through internal audit risk assessment, vulnerabilities and risk points in asset management can be identified in a timely manner, allowing for the implementation of effective control measures to safeguard the safety and integrity of assets. This is of significant importance for the stable operation and long-term development of universities.

Enhancing internal ARAC contributes to the improvement of the internal control system in universities. Risk assessment and control are essential components of the internal control system. Strengthening internal auditing helps promote the establishment and improvement of the internal control system in universities, thereby increasing the effectiveness and efficiency of internal controls. Through internal control audit evaluations, universities can streamline management responsibilities, optimize processes, and ensure that internal controls operate effectively under laws, regulations, and institutional policies (Li and Wang, 2017).

Strengthening internal ARAC provides scientific support for university decision-making, thereby enhancing governance capacity and risk management levels. The results of internal ARAC offer decision support for university management. By identifying and analyzing risk points, management can gain a clearer understanding of the risks faced by the university and thus formulate more scientifically sound and reasonable decisions. This helps universities maintain stable development in a complex internal and external environment. Through the examination and supervision of various university operations, internal auditing can reveal problems and deficiencies in governance structures and risk management. By strengthening internal audit risk assessment and control, universities can improve governance structures, enhance risk management mechanisms, and boost governance capacity and risk management levels. This enables universities to better respond to changes and challenges in the external environment, achieving sustainable development.

Strengthening internal ARAC promotes the enhancement of both economic and social benefits in universities. By reinforcing internal audit risk assessment and control, universities can effectively prevent and reduce potential losses and waste during operations, thereby improving resource utilization efficiency. Additionally,

optimizing internal audit work can contribute to enhancing the quality of teaching, research, and social services in universities, increasing their social influence and competitiveness.

Internal ARAC provides essential support and protection for the development and construction of universities. With the continuous changes in both the internal and external environments of higher education institutions and the ongoing development of audit work, internal ARAC in these institutions also faces new challenges and opportunities. How to leverage new trends and technologies to continuously innovate audit concepts and methods, in order to meet the demands of internal audit work in the new context, has become a key concern for higher education institutions.

3. The importance of applying AI technology to internal ARAC of higher education institutions

Driven by the wave of digitalization, AI technology, with its powerful data processing and analysis capabilities, is gradually becoming a significant innovative force in the field of internal auditing in higher education institutions. The application of AI technology to internal ARAC not only helps improve the efficiency and accuracy of auditing work but also comprehensively enhances risk identification and early warning mechanisms, supporting the digital transformation and intelligent development of internal auditing in higher education institutions.

3.1. Feasibility of integrating AI technology into Internal ARAC of higher education institutions

Traditional internal auditing methods are often limited by manual operations and data processing capabilities, making it difficult to meet the rapidly evolving needs of modern higher education institutions. With the continuous advancement of artificial intelligence technology, its advantages in data processing, pattern recognition, and risk prediction are gradually emerging, offering new solutions for internal ARAC in higher education institutions.

Moreover, by leveraging computer technology, key tasks can be quickly identified, reducing the workload of calculations and document organization. This allows auditors to devote more time and energy to more effective management tasks, such as critical verification and consulting, thereby forming a new auditing methodology.

Existing studies have shown the positive impact of building an information-based internal auditing platform for higher education institutions. For example, through its internal auditing information platform, Shanghai University can conduct process-based supervision, risk assessment, and warning record management of the overall operations of the audited units. This enables the audit process and management to be moved forward, achieving comprehensive audit supervision before, during, and after events (Zhang et al., 2017). The application of AI technology in risk assessment has two aspects of feasibility. The first is the improvement of efficiency and accuracy in risk assessment. Traditional risk assessment methods typically rely on manual analysis, which is limited by human resources and time constraints, making it challenging to comprehensively and deeply assess the risks associated with the

economic activities of higher education institutions. In contrast, AI technology can process large-scale data automatically and use algorithms and models to conduct in-depth analysis and mining of the data, quickly identifying potential risk points. This not only improves the efficiency of risk assessment but also reduces errors and omissions caused by human factors, thereby enhancing the accuracy of the assessment. The second aspect is the realization of risk warning and real-time monitoring. AI technology possesses powerful real-time data processing and analysis capabilities, enabling real-time monitoring and risk warning for the economic activities of higher education institutions. By building risk warning models, AI technology can automatically identify risk signals such as abnormal transactions and regulatory violations, and promptly alert auditors. This helps auditors quickly detect potential risks and take effective measures for prevention and control.

AI technology has practical feasibility in internal ARAC within higher education institutions. The first aspect is the optimization of risk control strategies. AI technology can analyze and learn from historical data to identify patterns and trends in risk occurrences, providing auditors with targeted risk control recommendations. This helps auditors develop more scientific and effective risk control strategies based on the actual situation and risk characteristics of the institution, thereby enhancing the effectiveness of risk control. The second aspect is the improvement of automation and intelligence in control testing. Traditional control testing typically relies on manual execution, which is time-consuming, labor-intensive, and prone to errors. AI technology, however, can automate control testing, reducing the workload associated with manual operations. Additionally, it can use algorithms and models to intelligently analyze and evaluate test results, increasing the accuracy and comprehensiveness of the tests.

3.2. Application of AI technology in audit risk assessment: A case study from a higher education institution

3.2.1. Specific use cases of AI technology

In the audit work of a certain higher education institution, AI technology is primarily applied in the following scenarios: (1) data collection and analysis, where AI technology is used to efficiently process large volumes of financial data and accurately identify risk points; (2) risk warning, where the AI system monitors the financial status and economic activities in real-time, promptly detecting and addressing anomalies; (3) automated auditing, where AI is leveraged to automate the audit process, thereby improving work efficiency.

3.2.2. Data preprocessing

1) AI technology is used to clean and organize raw financial data, ensuring the accuracy and consistency of the data.
2) Data analysis and risk assessment: AI algorithms are employed to conduct in-depth analysis of the data, identify potential risk points, and perform risk assessments.
3) Risk warning and monitoring: Risk thresholds are set, and when the AI system detects abnormal data, it promptly issues warnings.

4) Automated Auditing and report generation: The AI system automatically completes the audit process and generates detailed audit reports.

3.2.3. Problems addressed

1) Large data volume and high processing difficulty: AI technology can efficiently handle large amounts of financial data, accurately identify risk points, and reduce the difficulty and error rate of manual processing.
2) Risk identification and warning: Through the real-time monitoring and warning functions of the AI system, financial risks can be promptly identified and addressed, ensuring the financial security of the institution.
3) Cumbersome audit processes: AI technology has automated the audit process, simplifying cumbersome manual operations and improving work efficiency.

3.2.4. Achieved results

1) Improved audit efficiency: With the introduction of AI technology, the efficiency of audit work has significantly improved, greatly shortening the audit cycle.
2) Summary: By introducing AI technology, both data processing time and audit report generation time have been significantly shortened, reducing the overall audit cycle by half and greatly enhancing audit efficiency.
3) Enhanced risk control capability: The real-time monitoring and warning functions of the AI system have enabled the institution to respond promptly to financial risks, reducing risk-related losses.
4) Summary: The introduction of AI technology has made risk identification more accurate, and the time required to respond to risks has been significantly reduced, effectively enhancing the institution's risk control capabilities.
5) Optimized audit process: The automation of the audit process has reduced the possibility of human intervention and errors, improving the accuracy of audit results.
6) Summary: With the help of AI technology, the audit error rate has been significantly reduced, and data consistency has greatly improved, thereby enhancing the accuracy and reliability of audit results.
7) Conclusion: From the data in **Tables 1–3**, it can be seen that after the introduction of AI technology for auditing at a certain university, significant improvements have been achieved in audit efficiency, risk control capability, and the accuracy of audit results. These specific figures provide strong data support for the enhancement of the university's auditing work and demonstrate the great potential of AI technology in the field of auditing.

Table 1. Changes in audit efficiency after the introduction of AI.

Indicator	Before AI introduction	After AI introduction	Improvement percentage
Data processing time (hours)	100	40	Reduced by 60%
Audit report generation time (days)	5	2	Reduced by 60%
Overall audit cycle (days)	30	15	Reduced by 50%

Table 2. Changes in risk control capabilities after the introduction of AI.

Indicator	Before AI introduction	After AI introduction	Improvement
Risk identification accuracy	80%	95%	Increased by 15 percentage points
Risk response time (hours)	24	4	6 times faster

Table 3. Changes in audit process optimization after the introduction of AI.

Indicator	Before AI introduction	After AI introduction	Improvement
Audit error rate	5%	1%	reduce by 4 percentage points
Data consistency	90%	98%	Increased by 8 percentage points

3.3. What AI technology can bring to internal ARAC in higher education institutions

The application of computer science technology and the development of management information systems have greatly enriched the methods and tools available for internal auditing. Techniques such as surveys, management system diagrams, flowcharts, balanced scorecards, data packet network analysis, and computer-aided auditing have all become powerful assistants for internal auditing in participating in risk management (Cheng, 2019). The emergence of AI technology has provided new solutions and approaches for internal ARAC within higher education institutions.

AI technology can enhance the comprehensiveness and objectivity of internal ARAC in higher education institutions. Traditional risk assessment methods often rely on the experience and subjective judgment of auditors, which can be influenced by personal biases and cognitive limitations. In contrast, AI technology can extract key information from vast amounts of data and conduct multidimensional analysis and comparison, thus providing a more comprehensive and objective assessment of the risks associated with the economic activities of higher education institutions. Additionally, AI technology can incorporate the institution's specific circumstances and historical data to build customized risk assessment models, enhancing the relevance and effectiveness of the assessments.

AI technology helps optimize the process of internal ARAC within higher education institutions. Traditional risk assessment and control processes are often cumbersome and complex, requiring significant human resources and time. The application of AI technology can automate the processing and analysis of data, simplifying audit processes and improving the efficiency of audit work. Moreover, AI technology can provide real-time feedback and dynamic adjustments in risk assessment and control, allowing auditors to promptly grasp the risk situation and flexibly respond to various risk challenges.

AI technology drives the innovative development of internal ARAC in higher education institutions. As AI technology continues to advance and be applied, the methods and tools for internal ARAC are also continuously evolving. By introducing new algorithms and models through AI technology, and integrating other emerging technologies such as cloud computing and big data, a more intelligent and efficient

system for internal audit risk control and assessment can be built. This approach continuously optimizes the accuracy and efficiency of risk control and assessment.

AI technology helps improve the precision and timeliness of risk control. Through its powerful data analysis and processing capabilities, and by using machine learning algorithms and models, AI technology can automatically identify and predict potential risk points, providing real-time monitoring and warnings for the economic activities of higher education institutions. This, in turn, offers auditors precise risk control recommendations. Additionally, AI technology can automate and intelligentize risk control, reducing human interference and enhancing the timeliness and accuracy of risk control efforts.

4. Implementation approaches for applying AI technology in internal ARAC in higher education institutions

The application of AI in the audit industry is not a new concept; it has long been an important tool for assisting computer audit experts in making correct decisions. Over the past two decades, researchers have been dedicated to developing complex artificial intelligence systems, such as expert systems and neural networks, aimed at assisting auditors in their decision-making processes.

4.1. The application of expert systems and neural networks in the audit field

Expert systems are a significant branch of artificial intelligence, with their core function being the simulation of human expert knowledge and reasoning processes to solve complex problems in specific domains. These systems mainly consist of a knowledge base and an inference engine. The knowledge base stores a wealth of domain-specific knowledge, while the inference engine simulates expert thinking and uses logical reasoning to solve problems.

Expert systems can play a role in the audit stages of risk prevention and assessment. During the audit planning phase, which emphasizes risk prevention, expert systems can analyze financial data and historical records to identify potential risk areas, helping auditors determine key audit focuses. Additionally, by examining internal control systems, they can point out possible weaknesses and deficiencies. Expert systems can also automatically execute testing procedures during compliance testing to ensure that the institution adheres to relevant regulations and standards. In the audit evidence collection and analysis phase, where risk assessment is required, expert systems can guide auditors in obtaining sufficient audit evidence and ensure the relevance and appropriateness of that evidence. Furthermore, they assist auditors in preparing audit reports by providing in-depth analysis of financial statements and clear explanations of audit findings. Beyond the audit process itself, expert systems can help with continuous monitoring, detecting anomalies or suspicious transactions in the institution's financial activities in real time, and providing timely alerts to auditors. Although expert systems cannot replace professional human judgment, they serve as an auxiliary tool that can enhance the efficiency and quality of audit work.

As an important technology in the field of artificial intelligence, neural networks are computational models developed by simulating the functions of the human brain's

neural networks. These models consist of numerous nodes (often referred to as "neurons") that influence each other through weighted connections, enabling complex data processing and pattern recognition. In recent years, neural networks, as a powerful machine learning technology, have offered new solutions for audit work.

1) Anomaly detection. Neural networks can learn normal patterns of financial data and identify transactions or behaviors that deviate from historical trends. For example, they can detect sudden changes in financial data, helping auditors identify potential fraud or errors. This automated anomaly detection greatly enhances the efficiency and accuracy of audit work.
2) Risk assessment. By training neural networks to recognize different types of risk patterns, auditors can conduct more comprehensive risk assessments for higher education institutions. Neural networks can process vast amounts of data and identify potential risk points, providing auditors with deep insights into the institution's financial condition and risk status.
3) Predictive analysis. Neural networks can also be used to predict the financial performance and market trends of higher education institutions. Auditors can leverage these predictive results for deeper analysis, evaluating the financial health of the institution, and making more accurate judgments about its overall condition, thereby supporting audit decision-making.
4) Audit sampling. In traditional auditing, due to time and resource constraints, auditors often need to perform sampling audits. Neural networks can assist auditors in determining which transactions or accounts are most audit-worthy, enabling more targeted sampling, thereby helping auditors use resources more efficiently and improve the effectiveness of audit work.
5) Internal control evaluation. Neural networks can also be applied to assess the effectiveness of an institution's internal control system. By analyzing data related to internal controls, neural networks can identify control deficiencies and provide a basis for improving internal controls. This helps institutions enhance their internal control systems and improve financial management. The application of neural networks in the audit field offers new avenues for improving the efficiency and quality of audit work. However, as a "black box" model, the internal working mechanisms of neural networks may lack transparency, which can limit their application to some extent. Therefore, when using neural networks, auditors need to combine their professional knowledge and experience to ensure the accuracy and reliability of audit results.

4.2. Detailed information on the specific Al technologies

The application of AI technology in audit risk assessment and control has seen significant advancements, transforming the traditional audit process into a more efficient and accurate one. Here is a detailed introduction to specific AI models utilized in this domain:

1) Random Forest classifier

Random Forest is a widely-used machine learning algorithm that operates by constructing multiple decision trees and outputting the mode of the classes (classification) or mean prediction (regression) of the individual trees. This model can

be trained on historical audit data to identify patterns and anomalies that may indicate potential risks. By feeding features such as transaction amounts, dates, and categories into the model, it can predict whether a transaction is risky or not.

2) Named Entity Recognition (NER) and sentiment analysis

NER is a subtask of information extraction that seeks to locate and classify named entities in text into predefined categories such as persons, organizations, locations, etc. Sentiment analysis, on the other hand, involves determining the sentiment expressed in a piece of text, typically classifying it as positive, negative, or neutral. NLP models can be used to analyze text-based audit evidence, such as contracts, emails, and reports. NER can help identify key entities involved in transactions, while sentiment analysis can provide insights into the tone and sentiment of communications, which may indicate potential risks.

3) Predictive analytics models

Regression analysis is a statistical method used to model the relationship between a dependent variable and one or more independent variables. It helps in understanding how the dependent variable changes when the independent variables change. Regression models can be used to predict audit risk based on historical data. For example, an auditor may use a regression model to predict the likelihood of fraud based on factors such as transaction size, frequency, and geographical location.

4) Comprehensive AI risk assessment systems

These platforms combine multiple AI models and techniques, including machine learning, NLP, and predictive analytics, to provide a comprehensive risk assessment solution. These platforms can be used to automate the entire audit risk assessment process, from data collection and preprocessing to risk identification, assessment, and mitigation. They typically offer user-friendly interfaces and customizable risk assessment frameworks to suit different audit needs.

4.3. Construction of an internal audit model for higher education institutions based on AI technology

The application of AI technology in auditing encompasses multiple aspects, including but not limited to data analysis, risk prediction, automated auditing, continuous monitoring, intelligent decision-making, and compliance checks.

As shown in **Figure 1**, this article presents an example of an AI-based audit model designed to alleviate the workload of auditors and improve service quality by achieving 100% coverage of audit tasks through automation and intelligent technology. In the initial phase of the model, Optical Character Recognition (OCR) technology is employed to convert unstructured audit-related documents, such as paper files, contracts, and invoices, into editable and analyzable text data. Since OCR technology may introduce recognition errors, manual data entry is required to correct and refine the recognition results, ensuring data accuracy. Additionally, electronically entered data following established rules already contain accurate unstructured information.

Next, Natural Language Processing (NLP) technology is applied to the text data to understand and analyze language structure and meaning. NLP can extract key information, such as keywords, phrases, and concepts, from unstructured data. After

processing, the data is reorganized into a format that is easier to analyze, which is crucial for subsequent data cleansing and feature extraction.

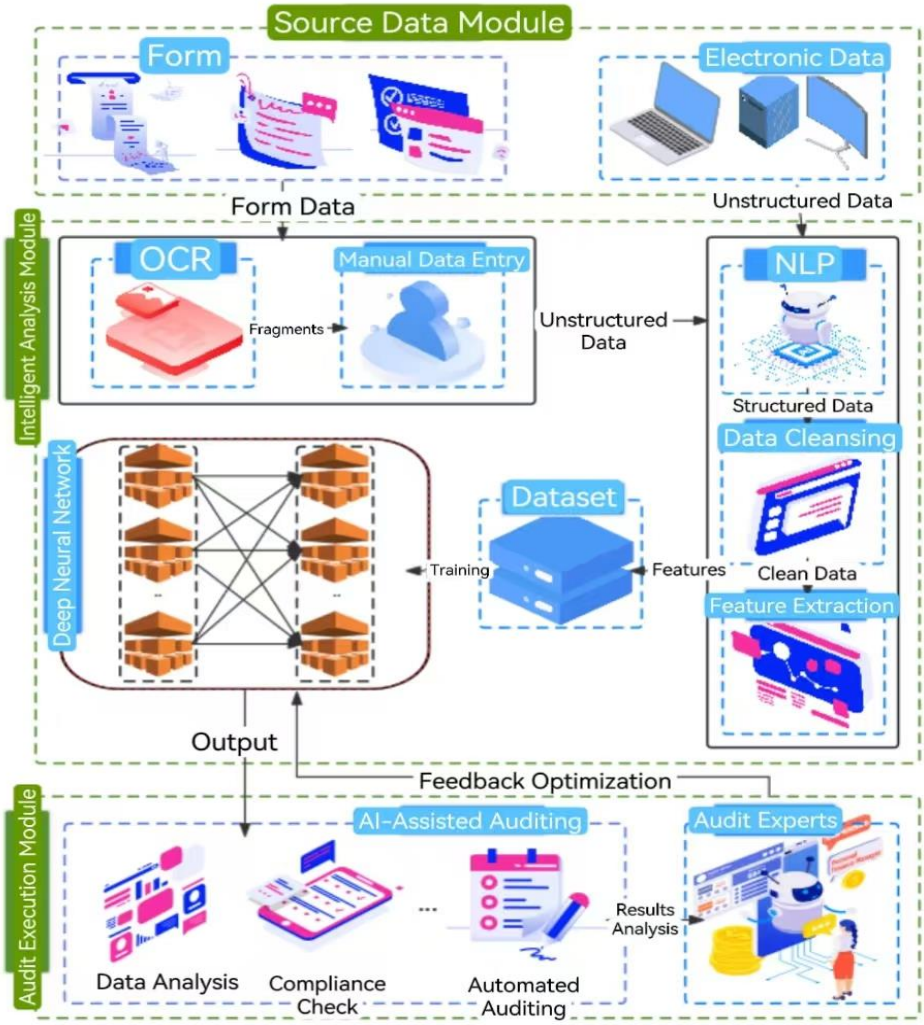

Figure 1. Internal audit model for higher education institutions based on AI technology.

The data cleansing step further ensures data quality by identifying and correcting errors, inconsistencies, and outliers, laying a solid foundation for feature extraction. Feature extraction involves pulling out information useful for auditing from structured data, such as transaction amounts, dates, and participants, and converting it into a format that can be processed by deep neural networks for subsequent analysis and model training.

Deep neural networks, the core of the model, learn and recognize patterns and trends within the dataset, outputting audit-related analysis results. These results include key audit aspects such as data analysis, risk assessment, automated auditing, continuous monitoring, intelligent decision support, and compliance checks. For example, in the data analysis stage, the AI-based audit system conducts in-depth analysis of these outputs, translating them into understandable reports and visual charts, thus providing a basis for auditors' decision-making.

Subsequently, audit experts make the final judgment based on the analysis results generated by the model, which may involve identifying areas for further investigation, proposing improvements, or taking corrective actions. Based on the analysis results and recommendations generated by the model, audit experts can focus on higher-risk audit plans, thereby achieving 100% coverage in audit inspections. Finally, auditors should provide feedback to further optimize the model, such as discrepancies between predicted risk levels and actual risk levels, ensuring that the audit model can continuously learn and improve. Feedback from the audit process is used to adjust algorithm parameters or retrain the model, enhancing the accuracy and efficiency of future audit work.

The AI audit model proposed in this article integrates advanced technologies such as OCR, NLP, and deep learning to achieve automated processing and intelligent analysis of audit tasks. This model not only improves audit efficiency but also enhances audit quality, enabling auditors to focus more on solving complex problems and making professional judgments.

4.4. Challenges in constructing an internal audit model for higher education institutions based on AI technology

The construction of AI models for risk prediction and control in auditing involves several challenges:

1) Data acquisition and processing. High-quality data is the foundation for building AI risk prediction models. However, obtaining comprehensive, accurate, and reliable data during the audit process can be challenging due to issues such as data silos, data quality problems, and data privacy protection. Additionally, processing large volumes of data requires efficient data processing technologies and methods, which is also a significant challenge.
2) Feature engineering. Feature engineering is the process of extracting meaningful features from raw data, which significantly impacts the performance of the model. In audit risk prediction, identifying and constructing risk-related features can be challenging, as it requires a deep understanding of the business domain and the data.
3) Model selection and optimization. Choosing the right AI model and optimizing it is crucial for building an effective risk prediction model. However, with the wide range of AI models and techniques available in the auditing field, selecting the most suitable model for a specific scenario and optimizing it is a challenge.
4) Generalization ability. Audit risk prediction models need to have good generalization ability across different scenarios and datasets. However, due to the diversity of audit environments and data, training a model with strong generalization capabilities can be difficult.
5) Interpretability and credibility. Audit risk prediction models need to be highly interpretable so that auditors can understand and trust the model's predictions. However, many AI models (such as deep learning models) often lack interpretability, which limits their application in the auditing field.
6) Ethical and privacy issues. When building and using AI risk prediction models, ethical and privacy issues must be considered, such as data protection, privacy

breaches, and algorithmic bias. These issues need to be thoroughly addressed during the design and implementation phases to ensure the model's security and compliance.

7) Human-machine collaboration. AI risk prediction models should be integrated with auditors' work to achieve human-machine collaboration. However, effectively leveraging the strengths of AI models while retaining auditors' professional judgment is a challenge that needs to be addressed.

In summary, the construction of AI risk prediction models in auditing faces numerous challenges. It requires the comprehensive application of various technologies and methods, along with the professional knowledge and experience of auditors, to achieve effective risk prediction and control.

4.5. How to improve the generalization ability of AI-based internal audit models for higher education institutions

Improving the generalization ability of AI-based internal audit models for higher education institutions is key to ensuring that the models perform well across different scenarios and datasets. This article proposes the following recommendations to help enhance the generalization ability of audit AI models.

1) Data preprocessing. Preprocessing the training data, including imputing missing values, handling outliers, and standardizing the data, helps reduce data noise and inconsistencies, which contributes to improving the model's performance across different datasets.
2) Data augmentation. Use data augmentation techniques such as random sampling, rotation, and flipping to expand the training dataset and increase model diversity. This helps improve the model's generalization ability on unseen data.
3) Feature engineering. Carefully selecting and constructing features related to audit risk can improve the model's predictive ability. Feature selection methods such as Recursive Feature Elimination (RFE) and Principal Component Analysis (PCA) can be used to reduce feature redundancy and enhance model performance.
4) Model selection. Experiment with different AI models such as decision trees, Support Vector Machines (SVM), and neural networks to find the model that is best suited for the audit risk prediction task. Additionally, consider using ensemble learning methods like Random Forest and Gradient Boosting Trees (GBT) to improve the model's generalization ability.
5) Regularization techniques. Apply regularization techniques, such as L1 regularization and L2 regularization, to prevent model overfitting, which helps improve the model's generalization ability on the test datasets.
6) Cross-validation. Use cross-validation techniques, such as k-fold cross-validation, to evaluate the model's generalization ability. This provides a more accurate understanding of how the model will perform on unseen data.
7) Model updating. Regularly update the audit AI model as the business environment and data change. This can be achieved by collecting new data, updating features, and retraining the model.

8) Domain adaptation. If the audit AI model will be applied in different domains or industries, consider using domain adaptation techniques to improve the model's generalization ability. This includes methods such as re-labeling data in the target domain and using domain adversarial training.

By implementing these measures, the generalization ability of audit AI models can be effectively enhanced, enabling them to perform well across different scenarios and datasets.

4.6. Limitations and implementation challenges of AI technology in practical audit work

The audit expectation gap is defined as the inconsistency between the audit practitioners believe they should exhibit and the expectations of audit report users. Regarding audit fees, there is a significant expectation gap between auditors and audit report users. Specifically, audit report users expect that the use of emerging technologies by auditors will reduce audit costs. However, auditors often need to maintain or increase audit fees to recover the costs of adopting new technologies, leading to tension due to this inconsistency in expectations.

Moreover, auditing itself is a complex activity that involves multiple disciplines. With the rapid development of cutting-edge information technologies such as artificial intelligence, big data, cloud computing, and blockchain, the complexity of audit tasks continues to increase. This requires auditors not only to have traditional accounting and auditing knowledge but also to possess the ability to apply emerging technologies. For instance, in tasks involving unstructured data, auditors need to use data processing technologies, which adds to the difficulty of auditing work. Identifying patterns from large datasets, for example, requires the use of complex big data analysis techniques such as clustering algorithms. These tasks demand that auditors handle and analyze large amounts of information, combine and interpret data in non-traditional ways, and adapt to changing information needs or clues to identify potential high-risk areas. Although current auditors have a solid foundation in accounting, auditing, and related fields such as economic management, finance, taxation, statistics, investment, and evaluation, there is still significant room for improvement in their ability to apply emerging information technologies to audit tasks.

Furthermore, the audit environment is a multidimensional, highly complex, and constantly evolving system, composed of various internal and external factors, including economic, legal, technological, political, and social dimensions. In such a dynamic system, audit work and the formulation and implementation of audit standards must be flexible and adaptive to ensure that they can respond promptly to the challenges and opportunities brought about by changes in the environment.

4.7. Innovations of AI technology in internal auditing in higher education institutions

Although AI technology holds great potential in audit risk assessment and control, it also presents some challenges, such as data privacy and security issues, and algorithmic bias. Therefore, in facing the challenges and opportunities that AI

technology brings to the audit field, the academic community must work together to adopt strategies to optimize the application of AI.

1) Through interdisciplinary research and collaboration, reduce the costs of technology implementation and enhance auditors' AI literacy. The audit industry should engage in deep collaboration with experts in fields such as computer science, data science, and statistics to jointly explore how to better apply AI technology for risk prediction and control. By providing training and communication, the AI literacy of auditors can be improved, enabling them to better understand and apply AI technology, thereby increasing the efficiency and quality of audit work.
2) Establish strict ethical guidelines and privacy protection measures to ensure the compliance and transparency of AI applications. In the audit field, AI systems need to process a large amount of sensitive data, so strict ethical guidelines must be established to regulate the use of AI systems and data processing procedures. At the same time, strengthen privacy protection measures to ensure the security and confidentiality of audit data, preventing data leaks and misuse.
3) Ongoing empirical research and case studies can help deepen the understanding of the impact of AI technology, promoting innovation and improvement in audit practices. Through these comprehensive measures, the audit industry can enhance the efficiency of AI technology use and the quality of auditing while ensuring effective risk management.

5. Conclusion

By deeply exploring the application of AI technology in internal ARAC in higher education institutions, we can see the immense potential and advantages that AI technology brings to auditing work. AI technology not only helps auditors more effectively identify and assess risks, improving the accuracy and efficiency of audit work, but also enables functions such as automated auditing and continuous monitoring, reducing the workload of auditors and allowing them to focus more on high-risk and high-value audit tasks.

However, we must also recognize that the application of AI technology in the audit field still faces several challenges, including data acquisition and processing, feature engineering, model selection and optimization, generalization ability, interpretability and credibility, ethical and privacy concerns, and human-machine collaboration. To overcome these challenges, it is necessary to comprehensively apply various technologies and methods, as well as the professional knowledge and experience of auditors, to achieve effective risk prediction and control.

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References

Cheng, J. (2019). Rethinking the Functions and Work Concepts of Internal Auditing in Higher Education Institutions-Based on the Essential Attributes and Functional Transformation of Internal Auditing [J]. Journal of National Academy of Education Administration, (01): 69–74.

China Institute of Internal Audit. (2009). Internal Audit Practice Guide No. 4-Internal Auditing in Higher Education Institutions [S]. 2009: 1–64.

Guillaume, G., Enisa, S., Colin, V., et al. (2024). Development and reporting of artificial intelligence in osteoporosis management. Journal of Bone and Mineral Research. (11), 11.

Hainous, M., Sekaki, Y., Amiri, I., Zaam, H. (2021). Internal audit and the modernization of moroccan public administrations [J]. World Organization of Applied Sciences, 3: 56–62.

Han, X. (2018). Discussion on the Application of Risk-Based Internal Auditing in Higher Education Institutions [J]. Co-Operative Economy & Science, 2018(20): 154–155.

Inigo, S. A., Tamilselvi, R., Parisa Beham, M. (2024). A review on imaging techniques and artificial intelligence models for osteoporosis prediction. Current Medical Imaging [J]. 2024(20.1): E080623217779.

Ivanov, S., and Biolchev, P. (2024). Ai effectiveness and risk assessment of investments in high-risk start-ups [J]. Strategies for Policy in Science & Education, 32: 158–166.

Li, H., Wang, R. (2017). New Developments in Internal Auditing in Higher Education: Participating in University Risk Management [J]. Finance and Accounting Monthly, (13): 119–124. doi: 10.19641/j.cnki.42-1290/f.2017.13.024.

Liu, Q., Xu, R., Tao, W. (2024). Impact of auditing information technology modernization on corporate technological innovation investment: the roles of risk perception and internal control [J]. Finance Research Letters, 67: 283–296.

Ministry of Education of the People's Republic of China. Regulations on Internal Auditing in the Education System [EB] (2020-03-20) [2024-03-28]. http://www.moe.gov.cn/jyb_xxgk/xxgk/zhengce/guizhang/202112/t20211206_585019.html

Natalja, A., and Anton, K. (2017). Application of recommendation blocks for conversion management of the internet store [J]. Technology audit and production reserves, 4(36): 4–8.

Pavlova, L. (2020). Modernization of the state internal financial audit system of the Russian federation [J]. Auditor, 6(11), 31–38.

Zhang, J., Jiang, X., Xu, K., et al. (2017). Research on the Role of Internal Auditing in University Governance [J]. Friends of Accounting, (13): 116–120.

Zhang, J., Xiong, L., Liu, Y., et al. (2015). Establishment and Optimization of the Internal Audit Information Platform in Higher Education Institutions-A Case Study of the Audit Information Platform of Shanghai University [J]. Internal Auditing in China, (11): 52–60.

Zheng, X. and Chen, Y. (2024). Research on risk assessment and management strategies of applying artificial intelligence technology in educational institutions. Applied Mathematics and Nonlinear Sciences, 9(1).