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Research on the Application of AI Technology in Auditing

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Abstract

With the rapid development of AI technology, the application in the field of auditing has become an important means to improve the efficiency and quality of auditing. AI technology has significantly improved the efficiency and quality of audit work by automating data analysis, risk assessment, and audit processes. However, as technology evolves, so do challenges such as data privacy, security, algorithmic transparency, and lack of talent. In order to address these issues, it is recommended to strengthen data protection, improve the accuracy and transparency of algorithms, formulate unified AI audit standards, and focus on cultivating audit talents with AI skills. In the future, the audit industry needs to actively manage and control risks while enjoying the convenience brought by AI, ensure the quality and credibility of audit work, and promote the development of audit services in a more efficient and intelligent direction.

Keywords: AI technology, audit quality, audit efficiency

1 Introduction

In today's rapidly developing information technology era, artificial intelligence (AI) has become an important force to promote profound changes in all walks of life, especially in the field of financial auditing, the introduction of AI technology is reshaping the traditional audit model. With the continuous advancement of AI technologies such as machine learning, natural language processing, and big data analytics, financial audit work has been significantly improved in terms of efficiency and quality, allowing auditors to focus more on strategic analysis and decision support. Through automated data

collection, cleaning, analysis, and risk assessment, AI technology not only improves audit efficiency and reduces error rates, but also enhances the depth and breadth of audits, enabling audit work to handle more complex data analysis tasks and meet the dual needs of modern enterprises for audit quality and efficiency. At the same time, the application of AI in risk management and compliance inspection brings a new perspective to audit work, which can quickly identify potential financial anomalies or risk points, give early warnings and take measures to ensure that enterprises' financial reporting and compliance meet higher standards. Despite challenges such as data privacy, security, and ethical use, the continuous development of AI technology indicates that audit tools and systems will become more intelligent in the future, capable of analyzing data in real time, predicting risks, automatically generating reports, and combining with other technologies such as blockchain and big data to further improve the efficiency and security of audit work, leading financial statement auditing into a new era.

2 Literature review

From the perspective of improving audit efficiency and quality, the existing literature generally believes that AI technology has greatly improved the accuracy and efficiency of audit through big data analysis, pattern recognition, and machine learning. For example, AI can quickly process and analyze large amounts of transaction data to identify unusual patterns that can provide early warning of potential financial problems or fraud. In addition, the application of AI technology in audit work, such as "AI Audit for Cash", has been able to efficiently perform key audit procedures including cash balances, bank balance reconciliations, etc., significantly improving the quality and efficiency of audits. However, while AI technology has brought convenience to audit work, its application also comes with ethical and risk management challenges. Some academics and experts have expressed concern that AI could amplify data bias and lack transparency and explainability. For example, AI systems may learn and mimic biases in input data, leading to unfair or discriminatory audit results. In addition, the "black box" nature of AI systems can make it difficult for auditors to understand and explain AI's decision-making process, increasing audit risk.

In response to these challenges, researchers and practitioners have put forward a series of countermeasures. For example, we need to train auditors with AI skills, formulate relevant systems to ensure information security and smooth operation of systems, strengthen the management of AI audit systems, and expand the application of AI technology in audit work to reduce costs and improve efficiency. At the same time, the audit industry should establish a responsible AI governance system to ensure that AI technology is safe, credible, compliant, and in line with public morality.

The application of AI technology in auditing is a double-edged sword, with both potential and risks. Future research and practice need to continue to explore how to effectively manage and control these risks and ensure the quality and credibility of audit work while enjoying the convenience brought by AI.

3 Application status

3.1 Application Progress

In the field of auditing, the application of AI technology is gradually becoming the norm, and many accounting firms have begun to explore and implement AI technology to improve the efficiency and quality of audit work. The application of AI technology in the audit work of law firms is gradually changing the traditional audit process. With AI tools, auditors are able to analyze data faster, identify risks, and improve the quality and accuracy of audit reports.

The Big Four international accounting firms were the first to apply AI technology to audit work, and the technology is relatively mature and widely used. Deloitte is one of the world's leading professional services networks and is at the forefront of AI audit applications. Deloitte's "Smart Audit" tool leverages machine learning and data analytics to automate multiple audit tasks, such as risk assessment, data analysis, and report generation. Deloitte also published a report on the current state of AI adoption in the enterprise, providing insights into how AI technology is being used in the enterprise. PwC also has significant investment and application in the field of AI audit. They have developed AI tools that can process large amounts of transaction data and identify potential risks and anomalies. PwC has incorporated AI technology into its services to improve the speed and accuracy of audits and explore new approaches to audits. EY is advancing the use of AI technology in audit services globally. They leverage AI for in-depth data analysis to identify key business risks and market trends. EY also focused on the application of AI technology in financial planning and analysis, and assessed the application and risks of generative AI in the field of auditing. KPMG is also actively embracing AI in its audit services. They use AI tools to improve the efficiency of their audit work, especially in risk assessment and transaction analysis. According to KPMG's survey, 82% of companies around the world have started to use AI technology for audits, and it is widely recognized that this technology can improve the efficiency and quality of audits. In addition to the Big Four international accounting firms, many local and regional accounting firms are also exploring the possibility of AI audits. While they may not have the resources and scale of the Big Four firms, they are also starting to implement AI in their audit services by adopting off-the-shelf AI software solutions such as Mindbridge AI.

3.2 Applied Technical Analysis

3.2.1 Machine learning techniques

The application of machine learning technology in auditing is mainly reflected in the automatic and intelligent processing of large amounts of complex financial data. By training machine learning models, auditors can leverage historical audit data to identify potential areas of risk and anomalous patterns. For example, supervised learning algorithms can identify anomalous transactions in financial data, helping auditors quickly locate possible fraud or accounting errors. In addition, machine learning can also assist in

risk assessment, by analyzing internal and external factors of the enterprise, predicting possible future financial problems of the enterprise, so as to formulate countermeasures in advance. During the audit planning phase, machine learning models can automatically generate risk assessment reports based on historical data and market trends to support audit decisions. During the substantive testing phase, machine learning techniques can be used to automate testing and improve the coverage and frequency of audits. At the same time, machine learning can help auditors understand the complex relationships behind data and provide deeper business insights. There are also some risks associated with the application of machine learning in auditing, such as the interpretability of algorithms, data privacy protection, and the definition of audit responsibilities.

3.2.2 Natural language technology

During the audit process, natural language processing technology can be used to extract and analyze textual information in financial reports. Through NLP technology, auditors can automatically extract key financial indicators and risk factors from financial reports, so as to assess the financial health of the enterprise more comprehensively. In addition, NLP can also be used to automatically generate audit reports and related analysis charts to improve the efficiency and quality of audit report generation. During the audit communication phase, NLP technology can help auditors understand and analyze management's explanations and statements to more accurately assess the financial position of the business. In addition, NLP technology can be used to automatically analyze customer feedback and market dynamics to support audit decisions. There are also certain limitations in the application of NLP technology in auditing, such as the diversity and complexity of languages, the quality and integrity of text data, and other issues.

3.2.3 Data mining technology

The application of data mining technology refers to the in-depth analysis and mining of large amounts of financial data during the audit process, so as to discover patterns, trends and anomalies in the data. Through data mining techniques, auditors can quickly identify potential financial problems and improve the accuracy and foresight of audits. For example, association rule mining can discover the relationship between different financial indicators, cluster analysis can identify trading groups with similar characteristics, and prediction models can predict the future financial status of enterprises. During the substantive testing phase of an audit, data mining techniques can be used to automate testing to increase the coverage and frequency of audits. At the same time, data mining can help auditors understand the complex relationships behind the data and provide deeper business insights.

3.2.4 Optical character recognition

Optical Character Recognition (OCR) technology can be used to automate the processing of financial documents and documents. With OCR technology, auditors can quickly convert paper invoices, contracts, and other financial documents into electronic format, speeding up the data entry and verification process. This not only improves the

efficiency of data processing, but also reduces human error and ensures the accuracy and completeness of financial data. During the data collection phase of an audit, OCR technology can automatically read and extract key information from financial documents, such as invoice number, amount, date, etc., thereby simplifying data entry. In addition, OCR technology can also be linked to the tax system to realize the automatic extraction and verification of invoice information, optimizing the audit process. The application of OCR technology has the problem of inaccurate information, so it cannot completely rely on the extraction of information, such as the difficulty of recognition of handwritten text, the impact of document quality and the accuracy of OCR technology, etc., which require auditors to screen and reprocess the extracted information to ensure the accuracy of the information.

3.3 Applied Content Analysis

3.3.1 Use data analysis for risk assessment

An important application of AI technology in auditing is in data analysis and risk assessment. Using machine learning and data mining techniques, AI is able to efficiently process and analyze a company's vast financial data sets, identifying patterns and anomalous behaviors in the data, which can be accounting errors or signs of financial fraud. By learning from historical audit cases, the AI system is able to predict and identify potential risk areas, providing data support and insights for audit decisions. For example, AI can analyze a company's financial report text, identify key financial metrics and disclosed risk factors, and even extract information from social media and news reports that has an impact on a company's reputation and market performance. The application of AI in risk assessment also includes building predictive models to assess the credit risk and market risk of enterprises, and using association rule mining to discover the relationship between different financial indicators. These technologies enable auditors to identify potential financial issues earlier, making audits more proactive and targeted.

3.3.2 Automate the audit process

The use of AI technology is often required in automating audit processes. Through automated tools, AI technology can be seamlessly integrated into an enterprise's information system to automatically collect and organize key information such as financial data, operation logs, and electronic archives in real time. This process not only reduces the need for manual entry, but also significantly reduces data errors and omissions caused by human manipulation. During the data cleansing phase, AI algorithms can effectively identify and eliminate invalid data and duplicate records, further ensuring the quality and consistency of the dataset used for analysis. When it comes to data analysis, AI technology can quickly identify abnormal patterns and potential risk points in data through advanced analysis models, such as anomaly detection algorithms and predictive analytics. The application of these techniques allows auditors to focus on solving more complex problems rather than spending a lot of time on basic data analysis. Finally, during the audit report generation phase, AI can automatically compile the audit report and even generate charts and summaries that include analysis of

key financial indicators and risk assessments. This not only improves the speed of report preparation, but also enhances the depth and detail of the report content, making the audit report more accurate and comprehensive.

3.3.3 Audit data visualization

AI technology can make data visualization in audit work. Through data mining and analysis, AI can extract key information from massive financial data, which can then be visualized in the form of charts and reports through visualization tools, so that auditors can quickly grasp the financial status and risk status of the enterprise. AI's multi-dimensional data analysis technology enables auditors to look at data from different angles and identify complex relationships between data through automatic classification, clustering, and predictive analysis. For example, AI can identify the correlation between different financial indicators and predict the future financial trends of the enterprise, and the analysis results can be transformed into intuitive charts and models through visual operations, helping auditors better understand the reasons behind the data. In addition, AI's deep learning technology has shown unique advantages in the visualization of high-dimensional data. It is able to map complex high-dimensional data to low-dimensional space through dimensionality reduction techniques, allowing auditors to observe and analyze data through two-dimensional or three-dimensional graphics. This visualization method not only reveals the internal structure of the data, but also shows how the data changes dynamically over time, providing richer and more dynamic information for audit decisions.

3.4 Application effect analysis

3.4.1 Improve the efficiency of audit work

AI technology is applied in data analysis and risk assessment, using machine learning and data mining algorithms to quickly process and analyze a large amount of complex financial data, automatically identify potential risks and abnormal behaviors, and improve the accuracy and foresight of audits. In addition to this, AI plays a key role in automating the audit process, through automated tools, AI can automatically collect financial data, perform data cleaning, analysis, and report generation, reduce the time and error rate of manual operations, and improve the accuracy and completeness of data. By providing advanced analysis tools, AI technology enables auditors to identify risk scenarios and data sources based on business risk characteristics, and design data analysis indicators to support data analysis and audit applications such as risk warning and continuous audit. At the same time, AI technology can also assist in the generation of audit reports, and use natural language generation technology to quickly create clear and accurate audit reports, improving the transparency and credibility of audit work. As an application of AI technology, robotic process automation simplifies external data mining, realizes real-time data collection, independently carries out transactional work such as data collation, analysis and comparison, optimizes the original audit procedures, and improves audit efficiency.

3.4.2 Strengthen audit quality control

AI technology plays an important role in improving audit quality. Through deep learning and pattern recognition, AI can predict possible future financial problems of enterprises, helping auditors assess risks more accurately. Natural language processing technology enables AI to understand and analyze textual information in financial reports, providing more comprehensive data support. In addition, AI's real-time monitoring capabilities allow auditors to identify and respond to emerging risks in a timely manner. AI can also assist in the generation of audit reports, and through natural language generation technology, clear and accurate audit reports can be quickly generated, improving the transparency and credibility of audit work. At the same time, AI technology is also applied to audit quality review, audit quality review is a key part of the audit process, to further ensure that the audit work meets professional standards and regulatory requirements, the accuracy and reliability of audit results AI can automatically perform some routine review tasks, such as checking the accuracy of financial statements, checking transaction records, etc., AI technology can be used to monitor the financial activities of enterprises in real time, providing continuous support for audit quality review. AI technology not only improves audit efficiency, but also reduces the time cost in the audit process. Auditors can use AI to quickly analyze large amounts of data, so as to complete a wider range of audit coverage in a short period of time, improving the responsiveness and flexibility of audit work.

3.4.3 Reduce audit costs

The introduction of artificial intelligence has had a significant impact on the cost structure of the audit industry. AI dramatically reduces reliance on human resources by automating repetitive audit tasks, thereby reducing human-related costs. The automation of audit work is not limited to the collection and collation of data, but also includes the automatic review of standard financial processes and the execution of routine analysis tasks, which can help reduce the time and labor costs in traditional audits. Anastassia Fedyk et al. at the University of California, Berkeley, have shown that as audit firms invest in AI technology, not only audit quality is improved, but audit costs are also effectively controlled, which shows that there is a positive correlation between AI technology investment and reduced audit costs. The application of AI also optimizes the allocation of audit resources. Auditors are freed from heavy transactional work to focus on more complex and value-added analytical tasks such as strategic decision support, risk assessment, and consulting services. This shift not only improves the quality and value of audit work, but also enables audit teams to more effectively respond to emerging risk areas and complex audit scenarios, further reducing audit costs.

4 Challenges

4.1 Data Security Risks

Data privacy and security concerns are particularly prominent when applying AI technology in audits. Audits involve the analysis of sensitive financial information about individuals and businesses, which can lead to damage to the company's reputation, legal liability, and loss of economic benefits. With the application of AI technology in the audit process, a large amount of data needs to be processed by algorithms, which increases the risk of data being intercepted and misused during transmission, storage, and processing. The complexity of AI systems often leads to a lack of transparency in their decision-making process, the so-called "black box" problem, which makes it difficult for auditors to interpret the decision-making logic of AI, which not only poses a threat to audit quality, but also brings new challenges to data privacy protection. In addition, the rapid development of AI technology has gone beyond the reach of existing regulations, leading to legal gaps in data protection and security, increasing compliance risks. At the same time, the AI systems used in audits may become the target of malicious attacks, such as hacker attacks, which requires auditors to not only focus on the application of technology, but also strengthen investment and protection measures for network security.

4.2 Inaccurate processing information

Although the application of AI technology in auditing has improved the efficiency of data processing and the intelligence level of audit work, there are also problems of inaccurate information processing. The performance of an AI system relies heavily on the quality and completeness of the input data, and the financial data can be incorrect or incomplete, resulting in biased AI analysis results. AI algorithms, especially models based on machine learning and deep learning, may struggle to accurately capture all relevant business logic and nuances in complex business scenarios, increasing the risk of errors in audit results. In addition, the black-box nature of AI makes the decision-making process lack transparency, and it may be difficult for auditors to understand and verify the decision-making basis of AI systems, which not only limits the credibility and effectiveness of audits, but also may lead auditors to rely too much on AI technology and ignore necessary human judgment and intervention. Although natural language processing and image recognition technologies are used in the processing of unstructured data such as text and images, the accuracy of these technologies still needs to be improved, especially when dealing with complex and ambiguous financial information. AI systems may generate false positives or false negatives in real-time monitoring and anomaly detection, affecting the timeliness and accuracy of audits.

4.3 Lack of unified technical specifications

There is a lack of unified technical specifications for the application of AI technology in the field of auditing. Different audit institutions may use different AI tools and methods, which makes it difficult to effectively compare audit results, affecting the consistency and credibility of audit work. In audit practice, it is difficult for auditors to ensure that their audit activities meet professional standards, which may increase audit risks and reduce audit quality. The lack of standards also means that auditors struggle to develop clear

guidelines for the selection, development, and implementation of AI technologies, which can lead to wasted resources and inefficient technology investments. At the same time, the legal and ethical issues of AI auditing are also further complicated by the lack of unified technical specifications, such as data privacy protection, algorithm transparency, and the definition of audit responsibilities. In terms of audit education, the lack of unified AI audit technical specifications and standards will also affect audit education and career development, because auditors are difficult to obtain consistent training and guidance, which affects their mastery and application of AI technology.

4.4 Lack of technical talents

The application of AI technology in the field of audit highlights the problem of lack of professional and technical personnel. With the introduction of AI technology, audit work has become more reliant on advanced data analysis and machine learning skills, which are not commonly found among traditional auditors. The challenge for audit institutions is how to find or cultivate interdisciplinary talents who understand both accounting and auditing knowledge and AI technology capabilities. AI audits require auditors to not only have a deep audit background, but also be able to understand and apply complex algorithms, conduct data analysis, and interpret AI-generated audit evidence. In addition, AI technology is evolving at a very fast pace, and auditors need to continuously learn and update their knowledge to keep up with the pace of technological development. The lack of talent not only limits the depth and breadth of the application of AI technology in auditing, but also affects the improvement of audit innovation and audit quality. At the same time, this has led to an increase in the cost of audit services, as the scarcity of professionals has pushed up their remuneration levels.

5 Countermeasures

5.1 Protect information privacy and security

Auditors need to establish strict data management and security protection mechanisms to ensure the security of all sensitive data during collection, storage, processing and analysis, including the use of encryption technology to protect the security of data transmission, and the use of access control and authentication measures to restrict access to data. Auditors should comply with data protection regulations, ensure that data processing activities are lawful and compliant, and establish transparent data processing processes so that data subjects can understand how their data is being used. In addition, auditors should receive professional training in data privacy and security to raise their awareness of the importance of data protection and equip them with the necessary knowledge and skills. At the same time, audit institutions should conduct data security risk assessments and audits on a regular basis to discover and repair potential security vulnerabilities in a timely manner. In the process of development and deployment of AI systems, the interpretability and transparency of algorithms should be taken into account to ensure the openness and transparency of the audit process and enhance the credibility of audit results. Finally, auditors should also work with technology vendors, regulators, and

industry associations to jointly promote the development of security standards and the sharing of best practices for AI audit technology, so as to form a consensus on data protection within the industry.

5.2 Improve the accuracy of data processing

In view of the inaccuracy of data processing that may be caused by AI technology in audits, the audit industry needs to take various countermeasures to ensure audit quality. First, auditors should ensure that the AI systems they use are trained and operated on accurate and complete data to reduce analytical bias due to data deficiencies. Auditors should strengthen their understanding of AI algorithms, improve their ability to review the decision-making logic of algorithms, and ensure that the output results of AI systems can be reasonably explained and verified. Auditors also need to establish a quality control process for AI audits, including regular model performance evaluations and sampling checks of audit results to monitor the accuracy and consistency of AI systems. At the same time, it is necessary to strengthen the supervision of the application of AI technology in auditing, formulate relevant industry standards and operational guidelines, and clarify the scope and restrictions of AI auditing. In addition, auditors should work with technology developers to continuously optimize AI models, reduce algorithm errors, and improve the adaptive ability of the system.

5.3 Accelerate the formulation of technical specifications

There is an urgent need to establish a set of widely recognized AI audit technical specifications and operational guidelines within the audit industry, which should cover the entire process of development, deployment, maintenance, and audit of AI systems. Audit regulators and industry associations should take a leadership role in facilitating the exchange of best practices and working with audit practitioners, technology developers, and academia to develop these standards. Auditors should strengthen internal quality control to ensure that AI audit activities follow established auditing standards and internal control processes. In addition, the professional training of auditors should not be overlooked, and they need to have a deep understanding of AI technology to ensure that these tools can be properly applied and their results can be interpreted. In addition, the supervision of AI audit activities should be strengthened to ensure that the AI tools and technologies used in the audit process comply with the latest laws and regulations, and the methods and limitations of AI technology should be disclosed in detail in the audit report, so as to increase the transparency of the audit process. In addition, encouraging international cooperation and promoting the consistency of global AI audit technical specifications is also an important way to solve the inconsistency of technical specifications. Through the collaboration of international audit organizations and multinational audit firms, the harmonization and mutual recognition of auditing standards between different countries and regions can be promoted.

5.4 Pay attention to the training of technical personnel

At present, there is a lack of compound talents in the auditing industry who understand both technology and auditing. Auditors need to work with higher education institutions to develop and deliver education and training courses specifically for AI auditing to develop interdisciplinary talents with data analytics, machine learning, and audit knowledge. Second, in-service audit professionals are encouraged to participate in continuing education and professional training to enhance their understanding and application of AI technology, especially in the areas of algorithm understanding, data processing, and the use of audit software tools. Audit institutions should develop talent introduction and incentive mechanisms to attract experts in the fields of computer science, information technology and data science to join the audit team, and enhance the professionalism and innovation of audit work through interdisciplinary cooperation. At the same time, the audit profession can accelerate the growth of young professionals by providing them with hands-on experience through internships, apprenticeships and mentorship programs. Auditors also need to establish a knowledge-sharing platform to facilitate communication and learning among auditors and improve the mastery of AI technology across the team. In the process of developing and deploying AI audit tools, attention should be paid to user experience, ensure the ease of use and accessibility of the tools, and lower the threshold for auditors to use AI technology. Finally, the audit industry should actively participate in international exchanges and learn from the successful experiences of other countries and regions in the cultivation and use of AI audit talents.

6 Conclusion

This study deeply explores the application of AI technology in the field of auditing, analyzes the changes, benefits and challenges it brings, and proposes corresponding solutions. AI technologies, including machine learning, natural language processing, and big data analytics, have become key factors in improving audit efficiency and quality. By automating data collection, cleaning, analysis, and risk assessment, AI technology not only improves the accuracy of audit work, but also expands the depth and breadth of audits, allowing auditors to focus more on strategic analysis and decision support. However, the application of AI technology is not without risks. Data privacy and security issues are particularly prominent, with the "black box" nature of AI systems increasing audit risks, while data bias and algorithm transparency issues have also attracted widespread attention in the industry. In addition, there is a lack of unified standards and rules for the application of AI technology in the field of auditing, which affects the consistency and credibility of audit results. The lack of professional and technical personnel is also an urgent problem to be solved, and auditors need to have more advanced data analysis and machine learning skills to adapt to the development of AI technology.

In order to address these challenges, the study proposes a series of countermeasures. First, auditors need to establish strict data management and security protection mechanisms to ensure the security of sensitive data and comply with data protection

regulations. Second, the audit industry should improve the accuracy of data processing, strengthen the understanding and review ability of AI algorithms, and ensure that the output results of AI systems can be reasonably interpreted and verified. In addition, accelerate the development of unified AI audit standards and operational guidelines to improve the consistency and credibility of audit work. Finally, we should focus on the cultivation of technical talents, and cooperate with higher education institutions to develop education and training courses specifically for AI auditing, so as to improve the understanding and application ability of AI technology by auditors.

The application of AI technology in the field of auditing is a double-edged sword, with both huge potential and risks. Future research and practice need to continue to explore how to effectively manage and control these risks while enjoying the convenience brought by AI. The application of AI technology in auditing is promising, but it is also full of challenges. By taking effective countermeasures, the audit industry can take full advantage of the benefits of AI technology while reducing its potential risks and driving audit work in a more efficient and intelligent direction.

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