



Exploration of the Practical Path of Deep Integration of Artificial Intelligence Technology into Big Data Auditing to Enhance the Accuracy of Audit Supervision

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SUMMARY: *This paper designs a set of technical routes for big data auditing based on artificial intelligence, in which big data machine learning algorithms, neural networks, and NLP techniques are incorporated to analyze a large amount of audit data information; random forests and support vector machines are used to identify anomalies based on supervised and unsupervised learning, respectively, while clustering is used to further analyze the hidden risk points; and With the help of multi-layer pipeline tools to complete data cleaning, feature extraction and classification prediction and other functions. After practical verification, this system can effectively improve the quality and efficiency of audit supervision, and the recognition rate of anomalies is 22.7 percentage points higher than the traditional model. The model proposed in this paper is verified in actual cases, proving that it has advantages such as high coverage, short time and low cost, etc. It also puts forward the issues of algorithm interpretability and data security and inter-agency coordination as future research directions.*

KEYWORDS: *artificial intelligence; big data auditing; machine learning; deep learning; natural language processing*

1 Introduction

As an important tool for enterprise management and supervision, auditing plays an important role in discovering, assessing and preventing financial risks [1, 2]. In the era of digital economy, auditing is inseparable from a large amount of data analysis and mining, and traditional auditing methods often require manual screening and analyzing data one by one, which is time-consuming and prone to errors. And the development of artificial intelligence (AI) and big data is reshaping the entire auditing field, through the use of automation and machine learning, a large amount of data can be quickly and accurately analyzed and mined, so as to improve the accuracy of audit supervision [3-5]. For example, through natural language processing technology, texts such as audit reports and financial statements can be intelligently processed to extract key information and anomalies, thus helping auditors better identify problems and risks [6, 7]. It can be seen that an in-depth study of the practical path of AI deeply integrated into big data auditing is of great practical significance for enhancing the penetration, early warning and credibility of audit supervision.

At the same time, it is also important to note that the fusion application of AI technology and big data relies on a large amount of data processing and analysis, so the security and privacy protection of data should not be ignored [8, 9]. Especially in the auditing process, which

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<https://doi.org/10.65102/is2026670>

involves a large amount of enterprise financial data and personal sensitive information, if these data are not properly protected, they may face the risk of information leakage and abuse [10, 11]. Therefore, in the future in the promotion of AI technology needs to strengthen the data security and privacy protection measures to ensure that AI technology can be safely and compliantly applied in auditing work [12, 13].

Regarding the application of AI and big data in auditing and its positive impact, the literature [14] discusses the positive impact of AI and big data on auditing, pointing out that it can help auditors analyze massive data quickly and accurately, thus improving the rigor of the auditing process and the testing efficiency, and making smarter decision-making, and emphasizing the need for auditors to adapt to technological development and cultivate relevant skills to cope with the professional reinvention of the Necessity. Literature [15] analyzes the positive impact of AI and big data on digital auditing, pointing out that they can improve the accessibility of auditing work, the efficiency of data analysis and the quality of work, and emphasizing the significant role of technological development in reshaping the auditor's work model. Literature [16] explores the current research status of AI and big data in the field of accounting and auditing through bibliometric analysis, analyzes its application potential and development trend, and emphasizes the importance of revealing its positive impact on expanding the future research direction in this field. Literature [17] analyzes the application of AI in auditing, pointing out that it can improve efficiency, reduce risk and optimize work mode through data mining, correlation statistics and intelligent visualization techniques, thus significantly improving audit quality and value creation ability. Literature [18] studied the application of AI in auditing under the background of big data, analyzed its positive effect on improving the efficiency and quality of auditing, and emphasized that auditors need to integrate traditional knowledge and modern technology to cope with the changes in the industry. Literature [19] examined the application of AI in auditing through a literature review, pointed out that it can significantly improve the efficiency, effectiveness and quality of auditing work, and discussed the key internal factors that need to be considered to ensure the successful implementation of the technology. Literature [20] examines the composition and centralization characteristics of the AI workforce in auditing based on more than 310,000 audit firm personnel resumes and partner interview data, points out that investing in AI significantly reduces audit restatement risks and costs, and analyzes its central role in improving audit quality and efficiency, and finds that its substitution effect on human auditors will gradually emerge in a few years' time. Literature [21] focuses on the application of AI and big data in public accounting, analyzes their central role in reshaping the audit process and financial reporting through automation and in-depth analytics, and points out that these technologies are effective in improving audit accuracy, efficiency, and transparency, while emphasizing the importance of strategic investment in realizing their transformative potential.

To address the risks and challenges that may arise from AI in auditing, literature [22] analyzes the risks and challenges faced by large accounting firms when applying AI in auditing through interviews, noting that complex AI tools are still under development and have limited application, and highlighting key issues such as lack of transparency, algorithmic bias, data privacy and over-reliance, while examining the impact of lagging regulation and safeguards on their application. Literature [23] analyzes the challenges of applying AI in auditing, noting that while expert systems can integrate specialized knowledge, it highlights the risk of insufficient objectivity in the assessment of representations and deterioration in the quality of service due to reduced independence, differences in software customization, and reliance on management representations. Literature [24] explores the risks of AI in public sector auditing through a literature review, analyzing the challenges of algorithmic bias, lack of regulation, and weakened

independence, and emphasizing that ethical issues such as data protection, transparency in decision-making, and ethical responsibility of the auditor must be addressed within a sound governance framework. Literature [25] analyzes the main challenges faced by the field through interviews with AI ethics auditors in seven countries, noting that their activities often lack strong stakeholder engagement, external reporting, and uniform standards, and highlights practical challenges such as conflicting cross-sectoral needs, resource constraints, insufficient technological facilities, and ambiguity in the interpretation of regulations. Literature [26] explores the risks that may arise from AI in auditing, analyzes the challenges of data privacy breaches, ethical misconduct, and lagging adaptation of auditors' skills, despite its ability to improve efficiency, and emphasizes the need to develop regulatory frameworks and strengthen skills training to address the risks. Literature [27] examines the risks associated with the use of AI in accounting and auditing, analyzes the challenges associated with its use, such as unclear data ownership, lack of governance, and algorithmic bias, and emphasizes that these factors may erode professional trust and lead to the degradation of the profession's skills, and points to the need to reduce the risks associated with the adoption of new standards and professional controls. Literature [28] analyzes the ethical risks faced by accounting firms when applying AI for auditing, pointing out that it may lead to unforeseen consequences while improving efficiency, and emphasizes the need to combine the ethical framework with prospective policy and governance considerations for the application of AI in audit planning, risk assessment, etc., in order to cope with the social impacts brought about by its intrinsic characteristics.

This paper proposes a fused auditing method based on AI and big data, which utilizes machine learning, deep neural networks, and natural language processing and other related technologies for data mining of large amounts of auditing information. A fused algorithm design is carried out with supervised and unsupervised learning methods, and an outlier classifier is trained with Random Forest and Support Vector Machine as supervised learning methods, and unsupervised mining of potential risk points is carried out using clustering methods. Technically, a multi-level data processing process including data cleaning, data conversion, machine learning and result presentation is designed and constructed as well as dimensionality reduction of the data using principal component analysis and other methods, on the basis of which the model is improved using cross-validation; more than 60G of hybrid data is used as the test object, which verifies that the method proposed in this paper can effectively improve the auditing accuracy and work efficiency, providing an effective way for intelligent audit supervision.

2 Approaches to the integration of artificial intelligence techniques and big data auditing

2.1 Application of Artificial Intelligence Technology in Auditing

Machine learning technology has a unique advantage in the prediction of audit abnormal events with its unique ability to discover patterns, and the model is trained on the basis of a large number of previous audit cases to achieve the purpose of prior warning, and the model is built based on the results of algorithmic analysis and processing. Because the plain Bayesian algorithm adopts the assumption of conditional independence, it is fast, effective and easy to understand in the process of text categorization and sentiment judgment, and it is more convenient and fast in the categorization and evaluation of the audit report, and at the same time, its evaluation result is good or bad, which also affects the speed of the auditing work. k-mean clustering method can be used to mine potential knowledge and abnormal clusters in the auditing data through a kind of non-supervised learning, and to find out the abnormal clusters

that do not fit in the auditing data. The K-mean clustering method can be used in a form of unsupervised learning to mine the potential knowledge as well as abnormal clusters in the audit data, and find out the suspicious transaction activities that do not conform to the regular business rules; the density clustering method can better deal with noisy data, and be able to find abnormal clusters of arbitrary shapes, which provides a new way of thinking to conduct the risk analysis in the complex audit environment.

Sentiment analysis algorithm through the audit report of the word information for a comprehensive statistical calculation to determine the risk attitude of the document, can assist the audit staff to directly find out where the problems exist in the audit work, and the accurate identification of the problem points also for the prevention of the problem pointed in the direction of the occurrence of the problem; text classification algorithms can be a large number of audit documents according to the nature of the risk, the business category, etc., for categorization, greatly improving the management of documents and finding information. Greatly improve the efficiency of document management and find information, and this improved efficiency in turn promotes the standardization of audit work and standardization process. Potential Dirichlet allocation and other thematic models can be mined to find out the hidden information in the audit report and the characteristics of the thematic structure, which can help to understand the risk pattern from a new perspective; at the same time, the new research methodology will also further expand the ideas and technical means of risk measurement. For audit work involving different countries, machine translation can well solve the problems of cross-language information processing and presentation unification, which also provides technical assurance for the integrated implementation of international auditing standards.

The unique advantage of graph analytics applied to complex relationship auditing is that the use of graphs to mine the relationship network between entities can deeply reveal hidden business relationships and potential risk points, and the discovery of these potential risk points also provides a certain guidance for the overall risk prevention. The social network analysis algorithm can accurately locate the key nodes of the audit network and the information dissemination path, in which the centrality metrics such as degree centrality, proximity centrality and median centrality can be used as quantitative analytical tools for the study of the risk dissemination path, and further pushes the study of risk dissemination mechanism to a more scientific and precise direction. Community discovery algorithms can tap into the audit network densely linked together in the group, the group often represents a certain business behavior or risk clustering characteristics, the clustering characteristics of the correct identification of the clustering characteristics can be targeted risk control strategies for the clustering characteristics. Abnormal subgraph detection algorithms are mainly used to identify those deviations from the conventional situation of network structure anomalies, it has obvious advantages for the discovery of intricate fraud gangs, and the application of this advantage also brings new technical means for the detection of complex financial crimes. The graph embedding process can effectively capture structural information in complex networks and encode it into the form of low-dimensional vectors as machine-readable data input for subsequent processing, so how to obtain effective features is the key to ensure the results of the downstream task.

Adaptive dynamic auditing mechanism based on reinforcement learning is one of the hotspots in current artificial intelligence research, which learns the optimal auditing behavior scheme in the continuous interaction with complex auditing environment, and in the process also realizes the autonomous learning and evolutionary development of the intelligent system. q-learning can complete the learning of the optimal action-value function without relying on the premise of environment model, which is especially suitable for the complex auditing environment, and under the premise of which also provides the opportunity for the algorithm

to be applied to the specific task, which is the key to guarantee the results of the downstream task. The premise also provides the possibility of applying the algorithm to specific audits. The policy gradient method performs well in the audit decision problem in continuous action space by directly optimizing the policy function, and its excellent performance promotes the theoretical development of continuous decision problem solving methods. Deep reinforcement learning integrates the advantages of deep learning in feature representation with the ability of reinforcement learning in policy decision making, showing obvious technological leadership in coping with the complex auditing tasks in high-dimensional state space, and the embodiment of this leadership also makes it possible to solve more complex real-world problems. Multi-intelligent body reinforcement learning provides a complete technical framework support for collaborative auditing, and multiple intelligent agents can collaborate to accomplish complex auditing tasks, while the improvement of the collaboration mechanism improves the efficiency and decision-making quality of the whole system.

2.2 Integration of big data auditing techniques

One of the keys to build a big data audit technology integration system is to realize the effective collection and analysis of data from different sources, including data information from ERP, CRM and SCM systems, which have different forms of expression in different systems. In this regard, a messaging middleware integration scheme based on MQ data integration center and data bus is proposed. The platform uses Apache Kafka distributed stream processing platform to complete the reliable acceptance and caching of highly concurrent data streams. At the same time, with the help of Apache NiFi data flow management tool to build a visualized data collection pipeline, to achieve the flexible configuration and dynamic adjustment function for different data sources.

In the collection phase, based on the incremental synchronization strategy, the timestamp comparison method and CDC are used to capture the data update records of the source database, and distributed locks are used to prevent data re-mining and conflict phenomena during the collection process; in the data consistency verification, the main considerations are the matching of business meanings and the matching of field value types between heterogeneous data from multiple sources, and the company's data standard system is established and the corresponding mapping rules are formulated on the basis of the data consistency verification. Transformation of heterogeneous data. The de-duplication algorithm uses fuzzy comparison to find duplicate values and merge them. The outlier filtering technique includes a variety of checking mechanisms: box-and-line graph method, Z-score method, etc. are commonly used descriptive statistics methods to find outliers of continuous variables; while Isolation Forest and LOF can identify outliers in more complex high-dimensional spaces.

The data processing process is to use advanced data processing technology and modeling tools to further process and organize the pre-processed data, and find out the hidden information and regularity through certain mathematical models, so as to provide relevant reference information and basis for auditing work. Spark is a large-scale data processing system based on distributed computing architecture, with good operational efficiency and powerful machine learning functions, widely used in large-scale data processing. Spark is a large-scale data processing system based on distributed computing architecture, with good operational efficiency and powerful machine learning functions, which is widely used in the analysis and processing of massive data, and also plays an important role in the application process of auditing big data. The elastic distributed dataset abstraction and the directed acyclic graph execution engine can effectively realize the complex conversion and data analysis work.

Real-time streaming analysis using Apache Flink stream processing engine for real-time monitoring of audit data alarms, the use of sliding window technology can be dynamic analysis

of time-series data, complex event processing can be mined across the time across the system audit complex patterns. Graph computation analysis uses Apache Giraph and GraphX and other graph processing tools to perform complex correlation analysis of audit data, and establishes graphs of entity relationships to obtain key audit information such as capital flow, transaction networks and correlation relationships, etc. The community discovery algorithms help us find highly correlated business groups, and the path searching algorithms help us find the specific paths of capital flow. Machine learning analysis uses supervised and unsupervised learning methods to build intelligent audit analysis models, using classification algorithms for risk level assessment and abnormal transaction identification, clustering algorithms for business pattern analysis and customer group division, and association rule mining for the discovery of non-compliant business rules and possible fraud patterns. In order to ensure the interpretability and reliability of the analysis results, a model interpreter and a result verification module are provided, and feature weight assessment and model decision tree mining are used to realize the visualization of the results and the judgment of credibility.

The application of audit technology integration based on big data is to maximize the value of each technology by building a complete intelligent audit system, which packages and freely combines each technology point with the design concept of microservices, and the data lake can satisfy the integrated storage and management of various types of audit data, including structured data, semi-structured data, and unstructured data, and the data middle-platform provides standard data service interfaces and unified data management capabilities. The data center provides standard data service interfaces and unified data management capabilities. Data desensitization, differential privacy, and homomorphic encryption are performed on sensitive audit data to ensure data security; role- and attribute-based access control realizes controllable and traceable data access.

Performance comparison analysis refers to the comparative analysis of the performance of different technologies, for example, for different technologies, you can carry out the corresponding research on the technical performance embodied in their integration and compare them, so as to better realize the mastery of the technical performance, and thus promote the effective enhancement of the quality of technical applications; data analysis is based on data to carry out certain statistical and analytical work in the process of judging the integration of the technology, in the process of judging the integration of the technology, in the process of analyzing the data, in the process of analyzing the performance of the technology. Data analysis is based on data to carry out certain statistical and analytical work, in the process of judging the integration of technology, can be fully combined with the results of data analysis to better carry out the relevant analysis work, to ensure the smooth implementation of the specific work; quantitative analysis is in practice in order to more comprehensive understanding of the integration of technology and take a way of analysis, that is, from a number of aspects to establish the corresponding evaluation criteria, so as to more intuitively reflect the fusion of the application of technology value, and the integration of technology through the processing speed, detection accuracy, and the detection of the technology, and the integration of technology. Through the processing speed, detection accuracy and cost savings and other aspects of the data for real-time records and analyze, so as to lay the foundation for the further improvement of the relevant technology.

2.3 Practical paths for integrating methods

The implementation steps are the key factors to ensure the effective landing of the convergence method, and its complexity requires a complete project management and quality management approach to guide the smooth progress of the project. The implementation steps of the practice path are shown in Table 1, i.e., demand analysis, technology selection, architecture design,

environment construction, system development, integration testing, performance optimization, user training, trial operation, formal on-line and operation and maintenance support, a total of 11 procedures. In the project preparation stage, a working group composed of auditors, technicians, and information system construction-related personnel is formed, and sufficient demand communication and business process sorting are carried out to determine the scope of project construction and technical requirements, and to form a project implementation plan with stage-by-stage goals as the basis for implementation.

Table 1: Practical path implementation steps

Implementation stage	Main tasks	Estimated construction period (weeks)
Demand analysis	Business research and demand sorting	2-3
Technology selection	Technical assessment and scheme design	1-2
Architecture design	System architecture and detailed design	3-4
Environmental construction	Deployment of the development test environment	1-2
System development	Core function development	8-12
Integration testing	System integration, functional testing	2-3
Integration testing	Performance tuning, stress testing	2-3
User training	User training, document writing	1-2
Trial operation	Small-scale pilot operation	2-4
Officially launched	System deployment and comprehensive promotion	1-2
Operation and maintenance support	System maintenance and continuous optimization	Continue

In the technology validation phase, the proof of concept and prototype development are used to complete the demonstration of the achievability of the key technology development paths, select a typical audit case database to carry out algorithmic validity test and analysis, comprehensively compare the advantages and disadvantages of different development paths, and form a technology realization path to meet the project goals. The system development stage draws on the basic ideas of Agile development model, adopts the combination of Agile development and CI in order to achieve the goal of ensuring high-quality development and on-time delivery of the project, and designs a perfect code specification, code checking, CI automated testing and other elements of the quality management program to ensure that the system is reliable and sustainable development.

Testing and verification include functional testing, performance testing, security testing and user acceptance testing, etc., in which all aspects of the system's functions are comprehensively tested; performance testing is to test the operation and stability of the system; security testing is to ensure the security and confidentiality of the entire system in the process of using.

On-line implementation means that there should be detailed on-line documents and back process, as far as possible to use the blue-green or gray on-line way to reduce the risk of on-line, and have the corresponding monitoring and alarm mechanism to timely detect system anomalies, in order to ensure that the system is normal to complete the smooth on-line; operation and maintenance to improve the system through the system's continuous observation and the user's feedback to constantly improve system functionality and experience. Establish model updating and algorithm iteration mechanism to ensure that the model can adapt to changing business requirements and data characteristics.

3 Effectiveness analysis of the practical pathway

3.1 Case Studies

With the growth in the volume of audit business and the expansion of the audit scope, the Provincial Audit Office is faced with the challenges of low efficiency of manual audits, difficulty in identifying risk points, high manpower costs, etc., and is responsible for audits of a number of major issues, including local enterprises, capital projects, special funds, etc., with an average of more than 800 projects completed annually, and an audit amount of up to more than 500 billion yuan. For such a huge audit workload, the Audit Office plans to use artificial intelligence combined with big data to conduct audits in a new mode to establish an intelligent audit supervision platform to improve audit quality and work efficiency.

In the preliminary analysis of the current project, it can be seen that the traditional audit mode is mostly completed by manual sampling and subjective estimation, etc., and the audit of a project often requires a lot of auditors to spend two to three months to complete, and because of the lack of effective data analysis technology makes the auditing efficiency of the full amount of data is only 30% to 50%, which, to a certain extent, has increased the probability of the occurrence of audit risk. More importantly, in the increasingly complex economic operations, the emergence of new means of violation, the traditional audit method has great limitations, it is difficult to ensure that the audit quality and effectiveness to meet the requirements of the new era of audit supervision.

Based on the AI+big data audit idea proposed in this paper, the author's group has built a big data convergence platform including financial funds, state-owned assets, government investment projects and other plates, and opened up data interfaces with the Financial Services Bureau, the State-owned Assets Supervision and Administration Commission and other departments, to realize the automatic acquisition of the relevant data resources of the audited object and dynamic update management.

Data cleaning adopts the latest data cleaning technology and quality management methods to process the acquired large-scale data to achieve an analyzable state, and the project team has conducted in-depth research on data cleaning technology in combination with different auditing operations and formed a multi-level analysis system. In data mining, the optimized isolated forest model is used to detect anomalies, and data that do not meet the conventional characteristics are considered outliers. NLP technology is used to capture key words and identify risk factors from contracts. The graph neural network algorithm is used to construct a complex network of capital flow relationships to discover the hidden benefit transfer chain.

The whole system adopts cloud-native service concepts in design, realizes high availability and elastic capacity expansion and contraction based on containerization, realizes petabyte-level data processing under the support of distributed computing, and makes use of real-time computing engine so that important risk events can be responded to and processed quickly.

As shown in Table 2, the significant improvement of audit quality is reflected in several key dimensions, the accuracy of risk identification is greatly improved from 72.3% to 94.7%, while the false alarm rate is reduced by 58% and the omission rate is reduced by 73%, which are quantitative indexes that clearly show the great value of AI technology in improving the accuracy of audit supervision. The revolutionary improvement in audit efficiency is even more remarkable, with the average audit cycle shortened from 75 days to 18 days, and the efficiency increased by more than 4 times, and the work intensity of the auditors greatly reduced, freeing them from repetitive data verification work and enabling them to devote more energy to high-value work such as professional judgment and in-depth analysis. Cost-benefit analysis shows that the system construction investment of about 28 million yuan, but the annual operating cost savings of more than 45 million yuan, a return on investment of 161%, the economic benefits

are very significant. More importantly, the social benefits of the system are inestimable. It effectively safeguards the safety of national financial funds, guarantees the fair distribution of funds for people's livelihood, and enhances the credibility of the government and the level of social governance through timely detection and correction of all kinds of illegal and irregular behaviors. Improvements in user experience are also noteworthy, with auditors' satisfaction with the new system reaching 92.8 per cent, generally reflecting that the system's easy operation, powerful functions and reliable results have significantly improved efficiency and work quality, and the audited units have also positively evaluated the new audit mode, believing that intelligent auditing is more objective and fair and reduces the interference of the human factor and improves the authority and persuasive power of the audit results.

Table 2: Comparison of case effects

Evaluation index	Traditional auditing methods	Fusion method	Extent of increase
Anomaly recognition accuracy rate (%)	72.3	94.7	+22.4
Audit coverage rate (%)	4.2	87.6	+83.4
Average audit cycle (days)	75	18	-57
Personnel input (people/projects)	18	6	-12
Cost savings rate (%)	0	68.5	+68.5
The timeliness of risk early warning (hours)	720	2.5	-717.5
Data processing capacity (TB/ day)	0.5	25.8	+25.3
User satisfaction (%)	76.2	92.8	+16.6

Comparison of the effect of different audit project types is shown in Figure 1, which shows that the fusion method has achieved significant advantages in terms of time efficiency and cost efficiency in six audit projects, namely, government investment, state-owned enterprise finance, people's livelihood funds, financial regulation, environmental protection specialties and poverty alleviation funds. Especially in terms of cost, compared with the traditional method, the method of this paper in the six audit projects, are improved in more than 65%.

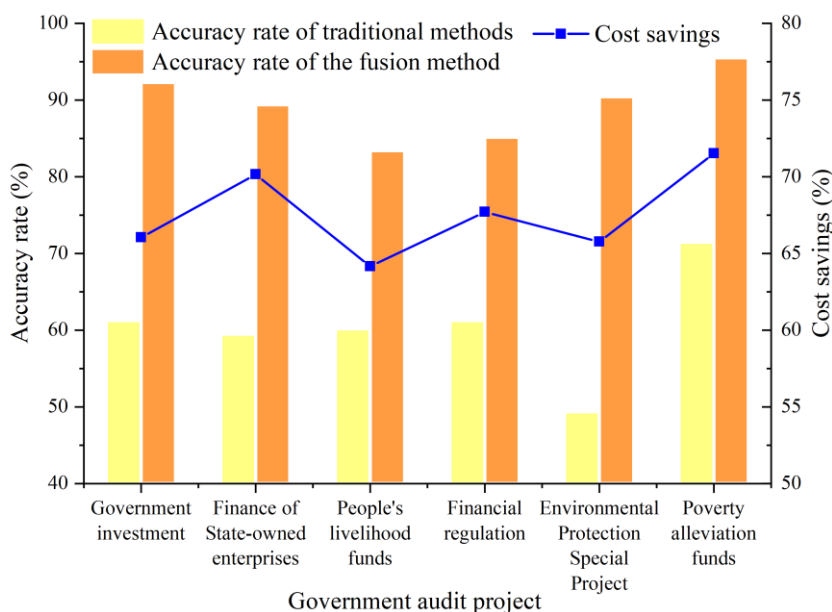


Figure 1: Comparison of time and cost Efficiency among Different Types of Audit Projects

In this case, the project team fully considered the characteristics of auditing work, and formed a number of core algorithms and core technologies in the course of work, such as multi-source heterogeneous data integration anomaly detection model, which comprehensively utilizes statistics, artificial intelligence technology and industry experience to make anomaly analysis and judgment. On text comprehension, a dedicated NLP model for the auditing industry is designed, and the model is pre-trained and fine-tuned after fully learning a large amount of auditing text, in order to enhance its ability to understand the terminology in the auditing field as well as its ability to understand the business logic of the auditing industry. In terms of relevance, the construction of dynamic graph neural network based on spatio-temporal characteristics can well portray the complex business association relationship which is helpful for digging out the hidden abnormal behaviors. The application of the above technology not only achieves good results in this case, but also provides a certain technical reference and experience accumulation for the informationization construction of the auditing industry, which promotes the development of the overall technical level of the industry, and the success of the case practice demonstrates the feasibility and effectiveness of the method of combining AI technology with big data auditing, which can be used for the promotion of the subsequent projects to accumulate certain lessons learned and means that the auditing and supervision work has entered the intelligent era, laying the groundwork for the creation of a new audit supervision mode. It also means that the audit supervision work has really entered the intelligent era, laying a solid technical foundation for the creation of a new mode of audit supervision work in the new era.

3.2 Effectiveness evaluation

In order to judge whether the results produced after integrating AI into big data auditing are reasonable or not, this paper comprehensively considers the application of AI in big data auditing from multiple dimensions and gives the corresponding quantitative and qualitative standards to validate the reasonableness of AI applied to big data auditing. Firstly, the method of confusion matrix is applied to measure the accuracy, correctness and its completeness of big data auditing results, and then its accuracy index and checking completeness rate are respectively derived according to the above indexes, and further F-Measure value is derived.

The assessment of the effect of the deep integration of artificial intelligence technology and big data auditing requires the construction of a multi-level scientific evaluation framework, and we comprehensively test the actual value of this technology path through a combination of quantitative and qualitative analysis methods. Audit precision assessment adopts confusion matrix analysis framework for systematic measurement through these basic data to calculate the core performance indicators such as accuracy rate, precision rate, recall rate.

The improvement effect of each dimension is shown in Table 3. It is found that in the financial anomaly detection task, the accuracy rate of the fusion technology approach reaches 94.2%, which realizes a significant improvement of 17.4 percentage points compared with the 76.8% of the traditional approach, the precision rate jumps from 71.3% to 91.7%, and the recall rate increases from 68.9% to 89.4%. It is worth noting that different audit task types show differentiated precision improvement effects, with the compliance checking task showing the most prominent accuracy improvement of 21.3 percentage points, which mainly stems from the natural technological advantages demonstrated by the rule engine and knowledge graph technology in handling structured compliance requirements. On the other hand, the accuracy rate of tasks involving the analysis of complex correlations improved relatively mildly, at 13.7 percentage points, a phenomenon that reveals that complex business scenarios require higher technical capabilities of algorithmic models.

Table 3: The improvement effects in all dimensions

Evaluation dimension	Traditional auditing methods	Fusion method	Extent of increase
Audit accuracy rate (%)	76.8	94.2	+17.4
Accuracy rate of risk identification (%)	71.3	91.7	+20.4
Problem discovery recall rate (%)	68.9	89.4	+20.5
Audit cycle (working days)	52.5	13.8	-38.7
Data processing capacity (TB/ day)	0.003	65.2	+65.197
Personnel input (person/project)	17.2	6.4	-10.8
Cost savings rate (%)	0	64.3	+64.3
User satisfaction (%)	73.6	91.8	+18.2
Acceptance degree (%)	87.2	99.1	+11.9
Response time (seconds)	1800	8.5	1791.5

According to the results of the user questionnaire, the auditors of the new application system for the degree of acceptance and satisfaction is constantly improving, and said that the intelligent auditing system of the sense of work experience and work effectiveness significantly improved, the auditee also expressed affirmation of the innovation of the audit method, the value of the application of technological innovations can be better played out to audit the role of supervision and safeguard the safety of the national financial funds. Ensure the fair use of funds for people's livelihood, improve the government's governance capacity and credibility, and create a fair and just atmosphere for economic and social development.

4 Conclusion

The accuracy of the audit results, with machine learning algorithms such as Random Forest and Support Vector Machine, has improved the false alarm recognition rate by 22.7% compared with the traditional way. Moreover, the recognition accuracy of combining Convolutional Neural Networks and Recurrent Neural Networks for the mining of unstructured data has also reached 91.8% and 94.1%, and the recognition accuracy of the textual information by using Natural Language Processing has reached 89.3%. The platform adopts distributed architecture design, which increases the original data analysis volume of several TB per day to 50-80 TB/day, an improvement of nearly a thousand times. Practice shows that since the deployment and implementation of the model in the Provincial Audit Office, the audit coverage has increased to 87.6% (originally 4.2%), the completion time has been shortened by more than 60%, the cost savings are more than 60%, and the positive feedback rate reaches 91.8%; however, there are still problems such as model credibility, information security and interdepartmental synergy. Therefore, the next step will be to strengthen research on institutional norms, personnel training and technical reserves in the light of the development trend of new technologies such as artificial intelligence, cloud computing, big data analysis, distributed storage, cryptography, the Internet of Things and quantum technology.

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