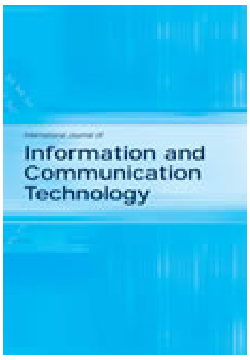

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Optimisation and application of management accounting system based on generative artificial intelligence

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Abstract: Management accounting (MA) systems need to process a large amount of time series data and dig out the patterns, analyse financial management problems, and predict subsequent development. This paper proposes an optimisation method of MA system based on generative artificial intelligence (AI), combined with the intelligent architecture of cloud computing (CC) program, this paper puts forward the generation method of MapReduce program in intelligent CC program. The analysis of data processing types of datasets and task requirements. The experimental results show that the F1 score of the model proposed in this paper is 0.9854, and the F1 score is better than the benchmark model on all datasets. In addition, this paper verifies the effectiveness of each module of the proposed model through ablation experiments. The customer satisfaction increased by 7.57%, indicating that the user experience of the optimised system is further improved.

Keywords: generative; AI; management committee; system optimisation.

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1 Introduction

With the rapid evolution of digital information technologies such as big data and AI, the group lacks top-level design in actual fund management, and generally faces problems such as weak fund control, lagging risk warning, numerous data islands and backward information systems, which makes it difficult for the traditional fund management mode to adapt to the new requirements of modernisation of management capabilities and digitalisation of state-owned assets supervision. As an advanced form of group fund management, modern treasurer focuses on fund centralisation and information centralisation, aims at improving fund operation efficiency, reducing fund costs, and preventing and controlling fund risks, and is guided by service strategy, supporting business, and creating value. Moreover, it uses new information technology to monitor and coordinate the financial resources of the group in real time, so as to realise that the financial resources such as the whole group's funds are 'visible, manageable, adjustable and well used', and better serve the development strategy of the group (Alawaqleh, 2021).

Accounting information system, as an indispensable part of modern economic activities, its core responsibility is to accurately record and report the economic activity information of accounting subjects. This system is not only responsible for the collection and storage of data, but also transforms the original data into information with decision-making value through a series of fine processing processes. Its value is reflected in the fact that it provides powerful information assistance to decision makers, ensuring that they can make informed choices when planning, implementing, managing and evaluating various activities. The existing accounting information systems are all constructed based on the accounting theory of value method. Moreover, accounting theory should devote itself to deriving the optimal input that is most beneficial to the decision model. This feature of value accounting makes it highly consistent with the accounting goal of 'fiduciary responsibility concept'. The two complement each other and together constitute the foundation of modern accounting theory (Asiaei et al., 2022).

The traditional decentralised fund management mode focuses on the operation of existing funds, which cannot fully tap the value of all financial resources. Meanwhile, the isolated fund management information system cannot realise business process collaboration, which affects the efficiency of enterprise fund operation, and there are security risks in fund use. Therefore, the group urgently needs to build a smart treasury fund management system that can support its own strategic development, and establish a digital platform that integrates industry and finance, which will help the group to improve its overall management and control and risk response capabilities, achieve industry-finance synergy and maximise overall capital benefits, and promote digital transformation (Dahal, 2021).

This paper proposes an optimisation method of MA system based on generative AI, so as to improve the processing effect of MA data and improve the efficiency of financial management. Moreover, combined with the intelligent architecture of CC program, this paper puts forward the generation method of MapReduce program in intelligent CC program. Then, based on the overall design of the CC program generation module, the CC program dataset task pre-processing, the analysis of data processing types of datasets and task requirements, and the MapReduce module program generation are performed.

2 Related works

2.1 Money management

Regarding the research of fund management mode, Dalle et al. (2021) hold that enterprises have different industry backgrounds and actual business operations, so the fund management mode can be divided into budget-driven allocation mode, cash pool mode, centralised monitoring mode, etc. Gutiérrez (2021) divided the centralised fund management mode into four categories: reimbursement centre, fund settlement centre, financial company and fund pool from the perspective of fund concentration, supervision intensity and scope of application. Hasan (2021) believed that the main capital management modes at present are settlement centre, financial company, internal bank and capital pool, and the capital pool mode is more helpful to balance the internal capital demand of the group and reduce the deposition of group funds.

Because each fund management model has its own different characteristics and values, and its applicable situations are also different, it is particularly important for the group to choose a scientific and effective fund management model on the basis of correct fund management concepts to achieve its fund management objectives. He et al. (2022) proposed that combining the fund management mode of finance company and settlement centre in enterprises can improve the effectiveness of the overall fund management of the group. Ismail (2023) proposed to reform the centralised fund management mode by combining centralised fund management with market-oriented fund allocation mechanism. After analysing the early warning mechanism of fund flow of group enterprises, Leitner-Hanetseder et al. (2021) put forward that the group's internal control environment, fund monitoring and analysis, etc. have an important impact on the choice of centralised fund management mode. Li (2022) hold that choosing the fund management mode from the perspective of enterprise centralisation and decentralisation will better reflect the strategic objectives of enterprise development and the appropriate fund management mode can also enhance the credit rating and financing ability of enterprises.

In the research of group capital risk management, Liu (2022) pointed out that there are certain risks in the whole process of enterprise capital from financing to investment, and on this basis, analyses the relationship between financing, capital allocation and capital risk. Mohamed and Ramli (2022) hold that under the background of informatisation, enterprises are likely to lead to settlement risks and information transmission risks due to backward hardware equipment and lack of fund management awareness of financial personnel. Muravskyi et al. (2023) hold that the financial risks caused by the shortage of funds can be reduced by scientific and reasonable budget preparation and the establishment of a centralised fund management system suitable for self-development to broaden financing channels. Nani and Safitri (2021) effectively promoted the advancement of financial work management and control and improved the level of risk management and control at the source of business work by further improving the data middle platform with the corporate financial sharing platform as the core. Ossola and Crovini (2021) believed that the organic integration of financial information system and business system can not only completely record the data of every link in the enterprise value chain, but also effectively reduce the risk of digital fraud. Pavlatos and Kostakis (2023) advocated incorporating process supervision into the digital transformation strategy of management functions such as finance, and using digital technology to support strategic fund management activities and regulatory reporting needs.

2.2 MA cost reengineering

In terms of business process reengineering, Pylypenko (2021) pointed out that business process reengineering is a technology that improves efficiency by optimising processes and reducing costs on the basis of thoroughly redesigning organisational structure. It combined traditional business process theory with ERP to redesign and reengineer enterprise accounting business processes and record accounting data in a more scientific and reasonable way. Ratnawati (2023) hold that the theory of business process reengineering provides new ideas for enterprise business process or organisational change, is a management tool for enterprise reform and innovation, and helps the realisation of enterprise development goals. Rustam et al. (2023) pointed out that financial process reengineering embeds real-time information processing into the business processing process to realise the integration of business and finance, thus driving the construction and improvement of financial information system.

Regarding the practical research of financial process reengineering, Tasya et al. (2022) analysed financial process re-engineering from the perspective of industry-finance integration, and believed that the new financial process reengineering needs to focus on demand, so as to improve work efficiency and increase process fluency. It proposed to use automation technology and information means to realise financial process reengineering, build an intelligent management and control platform for enterprises.

2.3 Accounting information system

The discussion on the definition and classification of events has begun, and at the same time, some progress has been made in the theoretical research on the process of event accounting information system. In the aspect of constructing event accounting information system, scholars generally agree that ‘event-driven’ is the core operation mechanism, and the basic structure of the system is composed of event, method library and model library. At the same time, the construction of information system should be carried out according to the actual business activities of each organisation (Wu et al., 2022).

Scholars have made great contributions to the development of event accounting theory. However, scholars have only put forward the ‘event-driven’ mechanism, but scholars have not discussed much about how this mechanism plays a role in the construction of accounting information system, that is, what framework the event accounting theory uses to guide the construction of accounting information system, resulting in the construction of event accounting information system still in the pipeline (Zhang and Zhu, 2022).

3 Optimisation of MA system

3.1 Architecture design of CC program intelligence

According to the limitations of current CC architecture in program design, this paper puts forward the intelligent architecture of CC program. The intelligent architecture of CC programs consists of six core components: belief and capability and so on. Among them, belief embodies the interpretation of the recognised objects and categories by the accounting automatic generation module in descriptive knowledge. The capability represents the operations that the accounting automatic generation module can perform in procedural knowledge. In addition, wish is the target state that the accounting automatic generation module wants to achieve, and it is the relevant description of the target state generated by the accounting automatic generation module after perceiving and understanding information. Planning refers to the selection and organisation of competencies by the accounting automatic generation module according to the wishes of the current state and strategic knowledge (special process knowledge), that is, the solution of problems. The behaviour control mechanism is the ‘controller’ of the automatic accounting generation module, which is responsible for the coordination of each module by the automatic accounting generation module and the intelligent operation of the automatic accounting generation module. The automatic program design of MapReduce program is realised under the intelligent architecture of CC program. The intelligence of CC program, as a capability of accounting automatic generation module, provides a service of automatic design and generation of programs to the real world. The architecture of CC program intelligence is shown in Figure 1.

The cluster structure in CC program intelligence is shown in Figure 2. The client submits a task requirement to the CC cluster. If the requirement of the task is solved by the accounting automatic generation module through wish decomposition. If the demand of the task needs to be solved by the automatic accounting generation module and acquaintances through wish decomposition.

The realisation mechanism of CC program intelligence is to establish a connection with the beliefs, abilities and wishes of the accounting automatic generation module after the accounting automatic generation module perceives the problem needs of the outside world. The accounting automatic generation module can generate MapReduce program planning for solving problems, thus realising the generation of CC programs. Execution indicates that the accounting automatic generation module will complete the planning steps of CC program generation. Among them, unintentional learning refers to the proficiency of the accounting automatic generation module habitually adjusting the ability application. Intentional learning means that the automatic accounting generation module actively acquires new technologies by interacting with acquaintances, or independently plans to deal with unencountered problems. The implementation mechanism of CC program intelligence is shown in Figure 3.

Figure 1 Architecture diagram of CC program intelligence

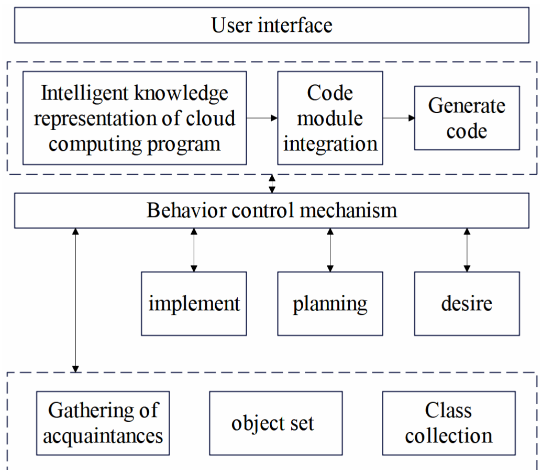
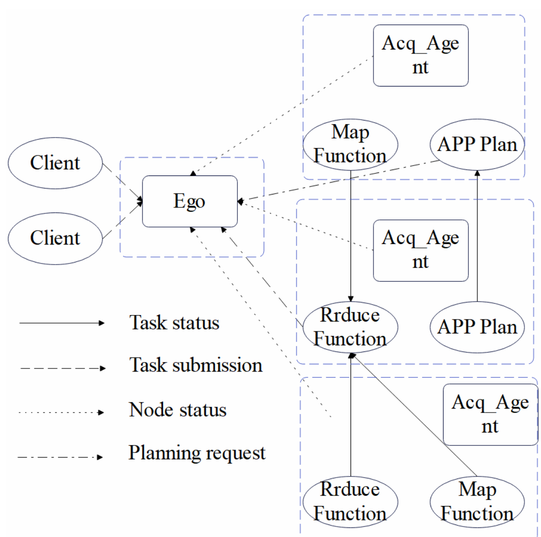


Figure 2 Structure diagram of intelligent cluster of CC program (see online version for colours)



3.2 *MA intelligent generation module*

Figure 4 shows the knowledge of the real world and the abstract world. The accounting automatic generation module, as a core concept, is closely related to the MapReduce program and dataset in the real world and the abstract world. The abstract world is the result of deep generalisation and refinement of the real world by human thinking, and it reflects human understanding and explanation of the real world. In the real world, datasets are diverse and complex. Because the accounting automatic generation module views things from different angles and cognitive structures, the same dataset may be interpreted as many different knowledge descriptions.

Figure 3 Activity diagram of implementation mechanism of CC program intelligence (see online version for colours)

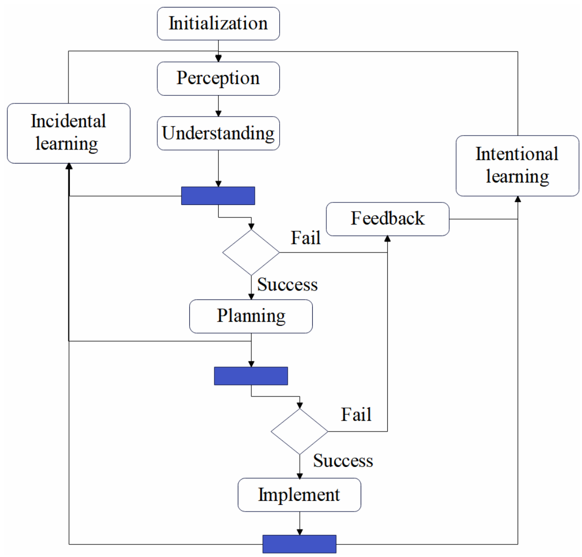
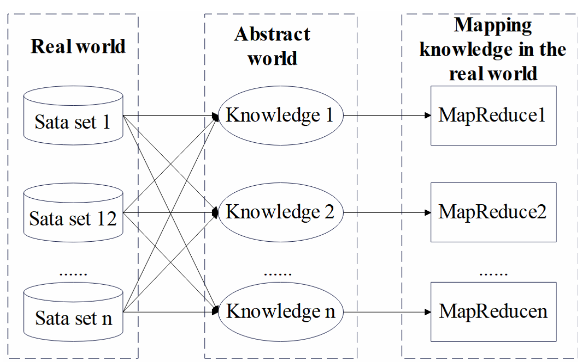


Figure 4 Knowledge in the real world and abstract world



In the overall design of program generation module in CC program intelligence, it is necessary to analyse that a data processing task suitable for using MapReduce program needs to meet the following conditions:

1 Task can be decomposed: the data processing task should be effectively decomposed into multiple sub-tasks, each sub-task can be processed independently, and there is no dependency relationship between different sub-tasks.

2 Large data volume: MapReduce is suitable for processing large-scale datasets, and the amount of data processed by the task should be large enough to make full use of the advantages of the distributed computing environment.

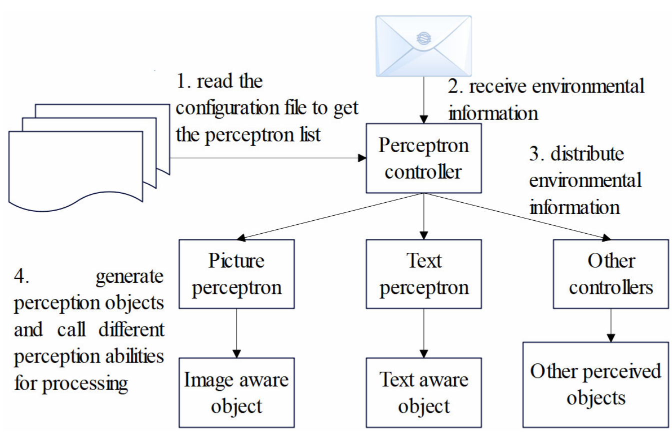
3 For a single data item: the MapReduce program processes in units of a single data item, so it is suitable for the task of calculating for each data item. Tasks such as word counting and page ranking all meet this criteria.

4 Generating key-value pairs: the intermediate results of MapReduce are all collections of key-value pairs, so they are suitable for tasks that generate key-value pairs as intermediate results. For example, tasks such as inverted indexing and image processing all meet this condition.

5 The reduce stage needs to be correlated: that is, the data task needs to aggregate, summarise and other operations of all values related to the same key in the Reduce stage.

The accounting automatic generation module generates a perception of the input document dataset after receiving the input dataset. The perception mechanism mainly consists of two core parts: message acquisition and information filtering. Among them, message acquisition refers to the process in which the accounting automatic generation module and its acquaintances classify inputs mainly through perceptrons and react to environmental information. The function of information filtering mechanism is that due to the complexity and diversity of perceived environment, the accounting automatic generation module needs to selectively receive environmental information. The operating mechanism of the perception module is shown in Figure 5.

Figure 5 Operation mechanism of perception module (see online version for colours)



The perception composition of automatic accounting generation module mainly includes three core components: concrete world, abstract world and behaviour control mechanism. Among them, the concrete world is a knowledge base that stores the perception information of things and environments in the real world of the automatic accounting generation module. At this stage, the automatic accounting generation module did not deeply interpret the current environmental information, but only perceived the changes of the external environment. When the external environment affects the automatic accounting generation module, the screened information will be incorporated into the specific world of the automatic accounting generation module in the form of entities, waiting for the subsequent in-depth processing and analysis of the automatic accounting generation module, and integrated into the knowledge base of the abstract world. Finally, through the decision-making of behaviour control mechanism, the automatic accounting generation module can efficiently process this environmental information, so as to make more accurate responses and decisions.

3.3 Data optimisation processing

TextRank algorithm is a text processing method, which is based on a directed weighted word graph model to extract keywords in documents. In the process of processing, the algorithm first divides the whole document into smaller basic units, namely words. A word graph model $G = (V, E)$ is constructed based on words, where V represents the node set composed of all words, and E is the edge set between nodes. The calculation method of the TextRank algorithm is shown in formula (1):

$$WS(V_i) = (1-d) + d \times \sum_{V_j \in in(V_i)} \frac{w_{ji}}{\sum_{V_k \in out(V_j)} w_{jk}} WS(V_j) \tag{1}$$

Among them, $in(V_i)$ represents the node set pointing to node v_i, $Out(V_i)$ represents the set of nodes pointed to by v_i, w_{ji} represents the weight of the edge w_i pointed to by node w_j, and d is the damping coefficient.

1 Entity text similarity: the similarity of the class to which they belong is obtained. The calculation process of cosine similarity is shown in formulas (2) and (3):

$$Sim_1 = \frac{A \cdot B}{\|A\| \cdot \|B\|} = \frac{\sum_{n}^{i=1} (A_i \times B_i)}{\sqrt{\sum_{n}^{i=1} A_i^2} \times \sqrt{\sum_{n}^{i=1} B_i^2}} \tag{2}$$

In Sim_1, A and B are two input vectors, and the value range of Sim_1 is [–1, 1]. Sim_1 is used to measure the text similarity between two entities A and B. Entity A is derived from the key entity identified in the text content, while entity B is taken from the entity information in the knowledge base of the accounting automatic generation module. R represents the predicted conclusion. When R is +1, it indicates that there is a connection between the two entities and the category relationship can be determined. The formula of the $sign(x)$ function is shown in formula (4):

$$R = sign(Sim(A, B)) \tag{3}$$

$$sign(x) = \begin{cases} -1, & x < 0 \\ +1, & x \geq 0 \end{cases} \tag{4}$$

2 Similarity of linked entities: if the two entities are similar, the entities in the dataset should be similar to other related surrounding entities in the knowledge base. Among them, Euclidean distance $D(A, B)$ is a measure of semantic distance between two

entities, which usually returns non-negative values. ρ numerically represents the weight between linked entities and plays a crucial role, especially in regulating and ensuring that when the semantic distance (namely, Euclidean distance) equals 0, the entire calculation or formula remains interpretable and valid. The calculation method is shown in formulas (5) and (6):

$$D(A, B) = \sqrt{\sum_{i=1}^{n} (A_i - B_i)^2} \tag{5}$$

$$Sim_2 = \frac{\rho}{D(A, B) + \rho} \tag{6}$$

3 Class similarity: after completing the calculation of entity text similarity, the similarity of the class can be further derived. There is a certain correlation between the two entities, but the weights of the classes they belong to are different. The class to which entity i belongs is represented by c, and the class set is represented by C_i, then $C_i = \{c_1, c_2, \ldots, c_n\}$. The formula Sim_3 based on the class factor is shown in formula (7):

$$C_i \sim C_j \tag{7}$$

When the class set to which entity i belongs is determined to be equivalent to the class set to which entity j belongs, it is considered that entity i and entity j meet the similarity of the class factor. The comprehensive calculation formula is shown in formula (8):

$$Sim(A, B) = \alpha \times Sim_1(A, B) + \beta \times Sim_2(A, B) + \gamma \times Sim_3(A, B) \tag{8}$$

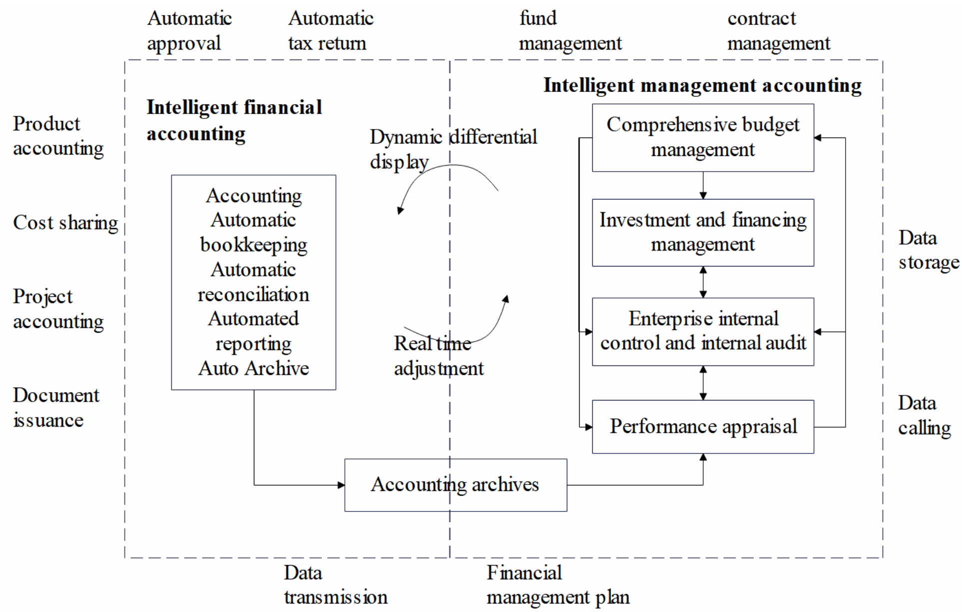
The calculation formula for calculating the similarity of entities is obtained by combining the calculation of three similarity factors. Among them, $\alpha + \beta + \gamma = 1$, and the higher the value obtained by the data entity similarity formula for entities A and B, the higher the similarity between the input entity information and the entities in the accounting automatic generation module knowledge base.

4 Test

4.1 Test methods

As the core platform of intelligent financial management system, intelligent generative financial platform is closely related to other platforms (Figure 6). First, robotic process automation (hereinafter referred to as RPA) technology is used to realise automatic approval and verification with the bank tax platform, automatic tax filing and other functions, and intelligent contracts can be used through blockchain technology to realise intelligent contract management with affiliated enterprises. Second, data is transmitted through the business platform to start the RPA automatic accounting process, and finally relevant vouchers and financial accounting statements are issued. Third, by transmitting accounting data to the big data analysis application platform, intelligent financial management solutions are obtained, covering multiple aspects such as fund management, budget management, investment and financing management, etc. providing refined services for comprehensive budget management under MA functions. Fourth, data is transmitted and called with the data platform, the basic platform.

Figure 6 Structure diagram of intelligent generative financial platform

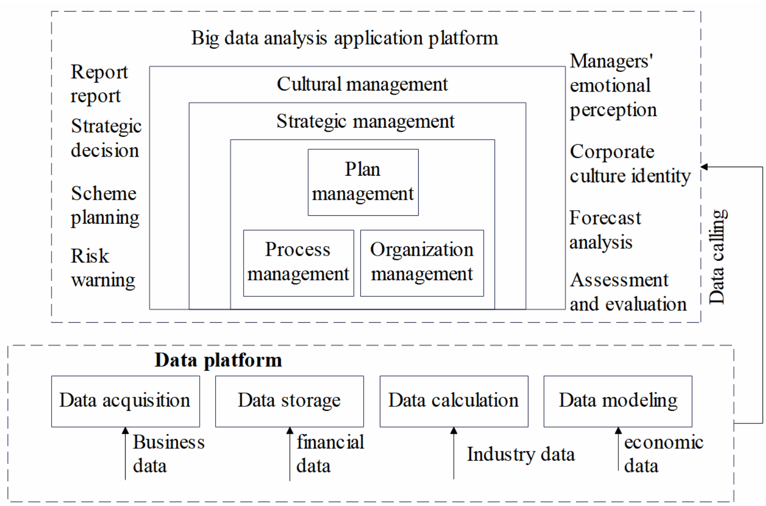


There are also circular calls of data and interconnections of functions within the intelligent financial platform. Intelligent financial accounting provides data support for intelligent MA to make budgets through information accounting. Then, intelligent MA will dynamically display the gap between actual records and budget data by comparing, so as to better adjust the budget and form a closed-loop optimisation loop.

The big data analysis application platform is the most intelligent embodiment of the three main platforms of the intelligent financial management system. The overall operation of the platform depends on the accurate call of a large amount of data in the data platform. Regarding the internal design logic of the platform, this paper sorts out the five contents of management work, namely, cultural management, strategic management, plan management, process management and organisational management (as shown in Figure 7). Among them, plan management, process management and organisational management are basic management contents. Plan management mainly uses the collected business and financial data for forecasting and analysis to achieve the purpose of reducing costs and increasing efficiency. Process management is mainly aimed at the planning of specific implementation plans such as business and finance being promoted, including intelligent simulation of plans and risk control in the process. Organisational management focuses on the rationality calculation of the distribution of powers and responsibilities within the enterprise and the evaluation of personnel, where the intelligent application of the theoretical model of MA can be realised.

The data of 30 representative listed companies are selected for experimental analysis, and the dataset of this paper is constructed. The experiments in this chapter are all implemented in the Pytorch library and use a single NVIDIA RTX 3090 24 GB GPU, and other configurations include 32G memory, Xeon (R) Platinum 8358P CPU. The long-term window size is 200 and the short-term window size is 100.The initial learning rate is set to 0.002, and the step-scheduler method is adopted, and the step size is set to 5.

Figure 7 Structure diagram of big data analysis application platform



The management accounting (MA) system based on generative artificial intelligence (AI) may unintentionally learn and amplify the biases present in historical accounting data. In this paper, the following operations are carried out in the system: firstly, reducing biases from the technical source through data cleaning (such as removing irrelevant sensitive attributes), balancing datasets (such as oversampling minority group data), and algorithm optimisation (such as introducing loss functions with fairness constraints); secondly, establish a manual review mechanism to cross validate key financial decisions output by AI and generate interpretable reports to explain the logical basis; finally, establish enterprise level AI ethical standards that explicitly prohibit the use of variables that may trigger discrimination, and regularly audit the fairness of the system by cross departmental teams. Through the three-layer protection of ‘technical correction+process supervision+institutional guarantee’, ensure that system decision-making is both efficient and fair.

To address the financial data security issues in the GenAI system of the cloud platform, the following measures are taken in this article: firstly, data anonymisation and field level encryption are used to protect the original data; Secondly, deploy a private AI architecture and combine it with a zero trust network (continuous authentication+ minimum privilege access) to control data flow; Simultaneously using differential privacy technology to inject controllable noise into the training data to prevent reverse inference; Finally, establish a third-party audit mechanism to record data usage logs through blockchain, ensuring full traceability throughout the entire chain. The key is to embed the ISO 27001 security standard in each stage of ‘data input model training result output’, balancing intelligent efficiency and trade secret protection.

To solve the compatibility problem between traditional ERP systems and GenAI tools, this article adopts a layered fusion solution: firstly, the structured data of ERP is converted into AI friendly formats such as JSON/Parquet through standardised data interfaces at the API middleware layer; secondly, deploy a hybrid AI architecture that retains sensitive core modules locally, while connecting non-sensitive business processes to cloud GenAI through encrypted pipelines; simultaneously utilising native AI extension packages from ERP vendors to achieve low code transformation and avoid disruptive refactoring; finally, establish a sandbox testing environment, first verify the stability of the interaction between the AI model and ERP transaction logic using historical replicas, and then gradually put it into production. The essence is to build a technology stack of ‘ERP data lake → lightweight AI adaptation layer → business application’, balancing system security and intelligent upgrading.

To address the dual challenges of team adaptability and regulatory compliance faced by generative AI MA systems, it is recommended to adopt a ‘gradual change+trust co construction’ strategy:

1 Customisation capability upgrade

   Develop modular AI assistants (such as Excel plugins/ERP embedded tools) that embed AI functions within familiar operating interfaces for accounting personnel; implement the ‘AI mentor program’, select internal seed users to receive supplier certification training, establish departmental assistance teams, and achieve skill transfer through sand table deduction in real business scenarios (such as budget deviation analysis).

2 Compliance sandbox mechanism

   Collaborate with regulatory agencies to establish a pilot compliance framework, conduct AI application trials within limited business scope (such as expense audits of non-listed company subsidiaries), synchronously generate transparent audit traceability reports (recording AI decision paths and manual correction nodes), provide risk assessment samples for regulators, and promote standard setting.

3 Dual incentive system

   Design a ‘human computer collaboration efficiency index’ to include the utilisation rate of AI tools and the number of problem interceptions (such as the proportion of abnormal invoices detected by AI) in performance rewards; At the same time, the role of ‘AI supervisor’ will be established, giving senior accounting personnel veto power and optimisation suggestion channels for system recommendation results, balancing technical adoption and professional authority.

4 Dynamic compliance engine

   Deploy an embedded AI monitoring layer for legal provisions, real-time association with regulatory databases (such as the Ministry of Finance’s accounting standards dynamics), automatically trigger the model re inspection process when new regulations are detected, and generate impact analysis dashboards (such as the impact of changes in revenue recognition rules on existing AI models) to assist legal and accounting teams in coordinating and adjusting system parameters.

This method aims to find a balance between technological empowerment and professional value preservation by reducing tool switching friction, building a controllable testing environment, and reshaping the human-machine responsibility relationship, systematically resolving transformation resistance.

To address the limitations of GenAI in integrating qualitative elements and contextual insights in MA, it is necessary to reconstruct the 'human-machine collaborative decision-making framework' and achieve dynamic balance through the following multidimensional technology integration solutions:

1 Context aware enhanced architecture

- Multimodal data pipeline: build an unstructured data transformation layer that integrates NLP (parsing meeting minutes/industry reports), OCR (scanning contract notes), and voice transcription (board discussion) technologies to vectorise qualitative information and inject it into the model. For example, transforming the management's risk preference statement into a [aggressive: 0.83] label and training it together with quantitative KPIs.
- Dynamic binding of knowledge graph: establish industry feature library and enterprise ontology library, and use graph neural network to enable AI to identify business context correlations. For example, when the 'Southeast Asian Tariff New Deal' event is identified, the cost model of the affected products is automatically associated with similar crisis response cases in history.

2 Hybrid MoE expert system

When the AI outputs the budget allocation plan, the system displays the confidence levels of each micro model (such as the cost model recommendation to reduce R&D investment with a confidence level of 72% vs. the strategic model recommendation to maintain a confidence level of 68%), and requires manual reference to the explanation of the divergence points for final decision-making.

3 Cognitive mirror training technique

- Cloning of management decision-making mode: by recording key debate points in historical decision-making meetings and using contrastive learning to construct a 'decision fingerprint', the AI output scheme is accompanied by the probability of human decision-makers' choices in similar historical scenarios.
- Counterfactual scenario sandbox: develop a virtual decision theatre that allows users to modify assumptions, observe how AI re balances quantitative constraints and qualitative strategy goals, and gradually establish an intuitive understanding of AI reasoning logic.

4 Human computer interaction neural interface

- Intuitive feedback reinforcement learning: develop a decision calibration panel, where when the accounting director rejects AI recommendations, the system collects natural language descriptions of the reasons for rejection through interactive questioning, and converts them into a new feature weight iterative model.

- Edge context capture mechanism: deploy lightweight context recording tools on mobile devices, allowing on-site managers to instantly annotate unstructured observations and update regional market risk models through federated learning without uploading raw sensitive information.

This solution reconstructs the context perception dimension of AI systems and digitally maps human expertise, while retaining the computational advantages of GenAI, transforming the intuitive judgements required for MA into an interpretable, interventionist, and traceable hybrid intelligence paradigm.

To reduce the construction cost of the GenAI enhanced MA system, the following strategies can be adopted: prioritising the use of open-source model frameworks for fine-tuning rather than training from scratch, and utilising idle computing power bidding instances from cloud service providers to handle non-real-time tasks; Reuse the data pipeline of existing ERP systems through modular design to reduce infrastructure reconstruction; Establishing joint laboratories with universities to exchange real business data for technical support from research teams; Adopting an incremental training strategy, only local model updates are performed on newly added business scenario data. At the same time, implement the ‘AI lightweighting’ plan, directly call APIs for non-core functions, and concentrate limited resources on key modules such as strategic forecasting.

4.2 Results

To demonstrate the overall performance and superiority of the model, this section will compare the proposed model with the 12 most advanced time series anomaly detection methods on the dataset.

Table 1 Model performance comparisons

	Precision	*Recall*	*F1*	*AUC*
VAR	0.7393	0.8061	0.8882	0.7712
LSTM-NDT	0.6225	0.9900	0.9437	0.7644
DeepSVDD	0.9100	0.7586	0.9244	0.8274
THOC	0.8757	0.9006	0.9475	0.8879
LOF	0.4724	0.8440	0.9297	0.6057
DAGMM	0.8870	0.6329	0.9081	0.7387
LSTM-VAE	0.8464	0.7914	0.9575	0.8179
OmniAnomaly	0.7770	0.9825	0.9684	0.8677
MAD-GAN	0.8431	0.9831	0.9763	0.9077
USAD	0.7870	0.9813	0.9697	0.8734
MTAD-GAT	0.7838	0.9726	0.9800	0.8680
TranAD	0.8966	0.9899	0.9827	0.9409
This study	0.9028	0.9931	0.9854	0.9436

The effect of each part in the model is further studied, and its performance on each dataset is observed. The results of the ablation experiments are shown in Table 2.

Table 2 The results of the ablation experiments

	F1
This study	0.9854
W/o transformer	0.8983
W/o flow-attention	0.9318
W/o feedback	0.9255
W/o adversarial training	0.9304

Figure 8 Training time for different window sizes (see online version for colours)

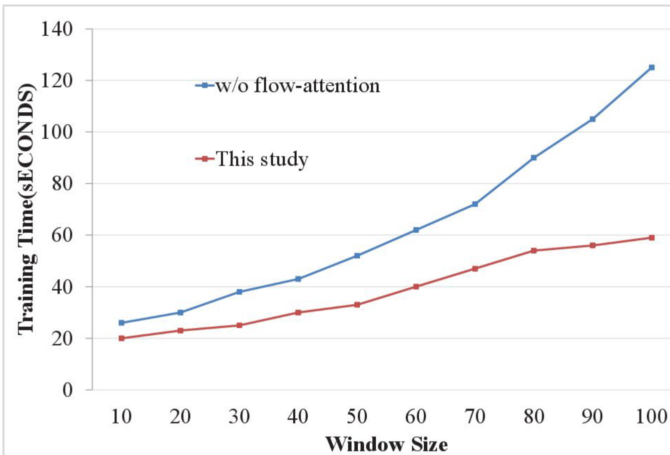
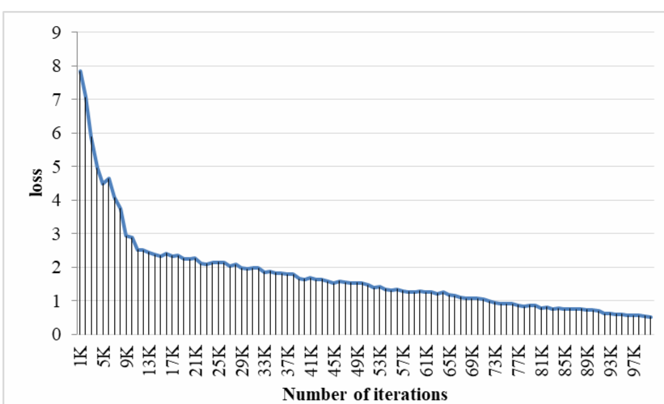


Figure 9 Pre-trained model loss diagram (see online version for colours)



The transformer-based autoencoder is replaced by the autoencoder composed of multi-layer sensors. Secondly, the flow-attention is replaced by self-attention, and the VanillaTransformer structure is adopted. Then, the feedback fraction $F = 0$ of the second stage is fixed, and the model without feedback module is considered. Finally, the case that adversarial training is not adopted, only single-stage reasoning is used to reconstruct the loss training model is studied. Figure 8 shows the training time using flow-attention and ordinary self-attention under different window sizes, and the training time is the average training time of all datasets.

The loss diagram of the generative AI MA model is depicted on the dataset, as shown in Figure 9.

To verify the optimisation effect of the generative AI MA system proposed, the optimisation model is constructed on the MATLAB model, and multiple financial accounting staff are asked to evaluate the experience of the model proposed and compare it with the existing financial accounting computerised system. For comparison, a total of ten sets of experiments are conducted, and the comparison results shown in Table 3 are obtained.

Table 3 Model experience comparison results

	Traditional model	*Optimisation model*
1	77.17	84.15
2	77.62	81.95
3	72.24	78.41
4	72.95	79.65
5	81.27	89.34
6	74.02	78.59
7	77.45	82.61
8	79.83	85.72
9	74.06	79.01
10	73.23	77.86

For the accuracy evaluation of the GenAI MA model, multidimensional quantitative indicators were used. Table 4 shows the accuracy recognition results of the model in this paper.

Table 4 Model accuracy evaluation form

Evaluation module	*Test method*	*Accuracy index*	*Industry benchmark comparison*
Tax compliance	100,000 invoices classification test	Accuracy rate 92.3%	The average of the four major institutions is 89%
Cash flow forecast	30 day rolling forecast	MAPE 6.7%	Industry TOP10 average 8.2%
Strategic decision support	1,000 Monte Carlo simulations	The filtering rate of the suboptimal solution is 83.5%	No publicly available benchmark data

4.3 Analysis and discussion

Table 1 shows the precision (P), recall (R), AUC, and F1 score of the benchmark model and the model proposed on the dataset. On average, the F1 score of the model proposed is 0.9854, which is better than the benchmark model on all datasets. Specifically, compared with the most advanced benchmark model TranAD, the F1 score of the model proposed increased by 2.78%. The poor performance of the benchmark method LSTM-NDT is mainly due to the inefficiency of sensitivity to different scenarios. The generative model used in this study sets more accurate thresholds by considering local peaks in the data series. In addition, DAGMM models do not score well on datasets with longer sequences. The reason is that it does not explicitly map the temporal information, it does not use sequence windows, and only uses a single GRU model. This study performs long-time series modelling by combining long-term time window coding with feedback scores, so that it can run better even under long high-dimensional sequences. The OmniAnomaly model uses continuous observation data as input, thereby preserving temporal information, but does not consider abnormal data when reconstructing, which makes it unable to detect abnormal data close to normal trends. This study solves this problem by using adversarial training to amplify anomalies. Table 1 show that the model proposed in this study achieves a consistent technical level on all benchmarks and achieves the highest F1 score. It can be observed that the generative AI learning model considering time information is superior to the general financial data anomaly detection model, and the model proposed in this study surpasses the existing model, proving that the model can not only learn time scale information, but also capture more fine-grained feature information.

After replacing the autoencoder composed of multi-layer perceptron with the autoencoder based on transformer, the average performance of the model decreases by 9.7%, which shows that the Transformer structure used in this paper is more suitable for capturing multivariate time series features. After replacing the transformer's flow-attention with self-attention, the average performance of the model decreases by 5.75%. At the same time, the training time increases, which is caused by intelligent model calculation. After removing the feedback module of the model, the F1 score decreased by 6.48% on average, showing the beneficial contribution of the feedback module to the prediction performance of the model.

According to the loss curve in Figure 9, as the number of training steps increases, the loss function curve continues to decrease, which shows that the generative AI MA model can fit the financial accounting dataset well.

In Table 3, the financial accounting staff's satisfaction with the existing computerised accounting model is 75.98, and the satisfaction with the MA system based on generative AI is 81.73. After optimisation, the customer satisfaction has increased by 7.57%, indicating that the user experience of the system has been further improved after optimisation.

Table 4 shows the following information:

1. The tax module performs better than the industry level, but 3.3% of the error mainly comes from cross-border business invoice recognition.
2. The error rate of cash flow forecasting still has a gap of 1.5% compared to the industry's optimal level, and seasonal fluctuation modelling needs to be strengthened.
3. The decision support module lacks comparable data.

It is recommended to add AB testing verification with expert decision-making. Overall, it meets commercial standards, but a continuous optimisation mechanism needs to be established.

5 Conclusions

This research mainly focuses on the optimisation method of MA information system, aiming at deeply studying its data processing and generative optimisation and discussing the application prospect of intelligent generative technology in the optimisation of MA information system. This paper proposes a MA system optimisation method based on generative AI, and analyses the performance of this method. Combined with experimental analysis, it can be seen that the generative AI learning model considering time information is superior to the general financial data anomaly detection model. The F1 score of the model proposed in this paper is 0.9854, and the F1 score is better than the benchmark model on all datasets, which proves that the model can not only learn time scale information, but also capture more fine-grained feature information. In addition, the effectiveness of each module of the model in this paper is verified by ablation tests. Finally, after system optimisation, customer satisfaction increased by 7.57%, indicating that the user experience of the system was further improved after optimisation.

The current model has three main limitations: firstly, the training mode relying on historical data is difficult to cope with paradigm shift scenarios such as accounting standard mutations; secondly, there is still room for optimisation in the collaborative efficiency of the rule engine and neural network in the hybrid architecture; thirdly, the false alarm rate of real-time environment perception is relatively high. Subsequent improvements will focus on three points: developing incremental learning algorithms based on causal reasoning to enable the model to identify the transmission chain of policy changes; Build a dynamic load balancer to automatically allocate computing resources between symbol systems and AI modules based on task complexity; Integrate multimodal industry intelligence streams (such as earnings conference call voice analysis) to improve warning accuracy. Ultimately achieving the evolution from ‘passive adaptation’ to ‘active prediction’.

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Declarations

All authors in this paper declare that they do not have any conflict of interest.

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