Construction of Information Architecture for Ideological and Political Teaching Management Driven by Deep Learning from the Perspective of AI Empowerment

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ABSTRACT The digital transformation of engineering education requires teaching management systems that can process learning data, evaluate professional development, and support curriculum coordination. This need is particularly relevant for students in textile engineering, electronic information, antenna technology, and electromagnetic wave propagation, where interdisciplinary knowledge and engineering ethics are increasingly important. From the perspective of artificial intelligence empowerment, this study constructs a deep-learning-driven information architecture for ideological and political teaching management. Recent literature is reviewed to identify existing limitations in data integration, teaching evaluation, and management feedback. An information architecture is then designed with four layers: data, algorithm, application, and guarantee. Experiments compare deep learning with traditional machine learning methods. For student performance prediction, the Bi-LSTM model achieves an accuracy of 87.6%, which is 15.3% higher than random forest. For teaching resource classification, the improved Attention-CNN reaches an F1-score of 0.89, outperforming SVM. The results also show stronger robustness of deep learning models in long-sequence learning behavior analysis. This study provides a data-driven management framework for engineering education and offers support for cultivating students in technical fields that combine material engineering, intelligent manufacturing, and electromagnetic applications.

INDEX TERMS deep learning, teaching management, information architecture, engineering education, learning analytics

I. INTRODUCTION

A. RESEARCH BACKGROUND

THE development of education is a priority among various undertakings in China, aimed at fostering virtue and cultivating people. "Ideological-political courses serve as the cornerstone for fulfilling this fundamental objective," ensuring future professionals, including those entering the textile manufacturing sector, possess the necessary ethical foundation [1]. In recent years, the requirements of the Central Government and the Ministry of Education have clearly stated that ideological and political education integrated into all courses (hereafter referred to as "curriculum-based ideological and political education") in colleges and universities has become an integral part of teaching management. The implementation of curriculum-based ideological and political education in colleges and universities requires exploring the ideological and political education resources embedded in various discipline courses and giving full play to the ideological and political education functions of each discipline [2]. The development of "curriculum-based ideological and political education" is an important way to enhance students' comprehensive quality, and it should be promoted throughout the entire process of course content design, teaching plan development, and teaching reflection. Currently, specialized research on "curriculum-based ideological and political education" in colleges and universities has become a hot topic in the academic community. We need to promote the reform and innovation of ideological and political courses, and constantly enhance their ideological, theoretical, targeted, and appealing nature [3]. Improving the teaching quality, standards, and effectiveness of ideological and political courses is of great significance to the development of the strategy of building a powerful education country [4]. As the times develop and social life changes, the teaching of ideological and political courses adapts to the times and trends, and is itself in a process of continuous innovation and development [5].

Amid the era of big data and artificial intelligence, profound transformations have occurred in societal lifestyles, alongside significant shifts in the teaching environments

and core elements of university ideological-political theory courses (hereafter referred to as "ideological-political courses"). The Party and the state have provided macro guidance and deployment for educational informatization. General Secretary Xi Jinping has repeatedly emphasized that ideological and political courses should be integrated with information technology [6, 7]. Harnessing technologies such as big data and AI to drive the innovative development of ideological-political courses is not only an inherent requirement for the courses' own advancement in the new era but also an inevitable choice to adapt to the evolving external environment of the intelligent age [8]. AI has been applied in the teaching of ideological and political courses, with typical application scenarios including daily management of ideological and political courses, practical teaching of ideological and political courses, teaching evaluation of ideological and political courses, and relevant theoretical research. The connection between AI and ideological and political course teaching can form different relational patterns such as assistance, empowerment, embedding, and integration. The innovative development of ideological and political courses in the context of AI has a solid practical foundation, including the technical mechanism of AI, the environmental pattern of digital existence, and the compatible connection between the two in specific links [9, 10].

At present, emerging technologies, particularly Artificial Intelligence (AI), are not only thriving in traditional fields but are also actively transforming highly specialized industries, including textile design and automated production. The application of AI in the teaching of ideological and political courses is an inevitable trend in the innovative development of ideological and political courses in the new era. Clarifying the principle framework that should be followed in application, grasping the opportunities and challenges faced, and identifying the key points for the integration of AI and ideological and political course teaching are of great significance to the in-depth research and practical development of ideological and political courses in the new era.

B. RESEARCH STATUS

With the advancement of technologies such as big data, cloud computing, the Internet of Things (IoT), blockchain, and 5G communication, a data-driven economy has taken shape. Data has obviously become an important factor in improving people's lives, promoting social progress, and driving economic development [11]. Supported by massive data and deep neural network algorithms, AI has the ability to process data and learn independently. Even in non-typical application scenarios such as the teaching of ideological and political courses in colleges and universities, AI has already made its presence felt. However, current research results on AI and ideological and political courses are still insufficient, and the depth of research needs to be improved. Some scholars divide AI into three main technical components: big data, deep learning, and high computing power. It is precisely these three core components that facilitate the integration of AI technology with ideological-political education. Cui Jianxi (2021) and Bai Xianliang (2021) proposed that AI has the characteristics of customization, ubiquity, and evolution [12]. The application prospects of AI in the field of ideological-political education determine the value and significance of relevant research endeavors. Lin Feng (2020) argued that it is impossible for AI to replace ideological and political education at present, and the degree of integration between the two is still very limited [13]. Wu Dongsheng (2019) and Hao Bowei (2019) pointed out that the current status of AI is "no intelligence without human input" [14].

Regarding the practical integration of AI into ideological-political education, some scholars have used SWOT analysis to examine the compatibility from multiple dimensions, including technical logic, value connotation, internal and external advantages, and challenges. The question of how AI can be practically integrated into the field of ideological and political education—i.e., which aspects and scenarios of ideological and political education have actually applied AI—has been analyzed by different scholars from different perspectives. Yang Rencai (2020) believed that AI can be integrated with the existing modules of ideological and political education [15].

The advent of the AI era has brought many opportunities and challenges to the teaching field of ideological and political courses [16]. Liu Minglong (2020) argued that AI expands ideological and political education in terms of time, space, and context: it increases the free time available for education, expands the space for ideological and political education, and highlights the ontological nature of education through the "primary existence" characterized by contextuality, situationality, and intermediacy [17]. Luo Liang (2021) held that AI makes the decision-making of ideological and political education more scientific, management more effective, implementation more refined, and evaluation more practical [18]. From the perspective of complexity science, Qin Lei and Zhu Jindong (2020) pointed out that the complex characteristics of AI, such as openness, dynamics, non-linearity, and emergence, are becoming increasingly prominent [19].

Regarding research on the development status of deep learning, Wang Jingjing and Zhou Aili (2020) [20], as well as Li Jiawen and Li Yubin (2019) [21], analyzed the literature in the Web of Science (WOS) database from both quantitative and qualitative perspectives. Their studies effectively revealed the dynamic changes and development context of foreign deep learning research in terms of research topics, reference literature, etc., from 2014 to 2018. The research results show that the research and practice of deep learning have expanded to various fields, including teaching methods, curriculum design, and learning evaluation, and the common goal of these studies is to promote the development of students' deep learning. This indicates that deep learning has expanded to more and more fields and has attracted

increasing attention and emphasis in the current era.

Although AI technology shows great potential in the teaching of ideological and political courses in colleges and universities, it also faces many practical difficulties in the actual application process. Zhang Sai, Pan Keli, and Xu Weizhong pointed out that in the process of AI empowering the teaching of ideological and political courses in colleges and universities, there are problems such as AI conflicting with the traditional teaching system of ideological and political courses, imperfect application standards and supporting mechanisms for AI, and insufficient efforts in cultivating interdisciplinary teacher teams. To address these issues, they proposed that colleges and universities need to return to the essence of "explaining principles" and build an intelligent teaching model; improve institutional mechanisms and optimize the intelligent management and assessment system; and promote interdisciplinary integration to cultivate high-capability interdisciplinary teacher teams. Yin Lingling also pointed out that there are various problems in the application of AI technology, such as immature technology and the lack of advanced intelligence possessed by humans. She believed that it is necessary to strengthen the research and development and application of AI technology, while improving teachers' technical literacy and application capabilities. These studies directly address the practical difficulties in the process of AI empowering ideological and political teaching, propose feasible countermeasures, and provide useful references for subsequent research and practice.

C. RESEARCH METHODS

1) Literature Review Method

In this study, a large number of recent literatures related to ideological and political education and AI —including books, periodicals, and theses—were collected, organized, read, and analyzed. Through careful preliminary work, the current research status was clarified, research gaps were identified, and these findings served as the basis for the key research content of this study. By summarizing the current stage of existing research, this study integrates with existing achievements and promotes the advancement of academic research on the innovative development of ideological-political courses in colleges and universities under the backdrop of AI from a suitable perspective.

2) Case Study Method

Practical cases of ideological-political teaching management in selected colleges and universities were studied to explore the experiences and shortcomings of AI empowerment and deep learning in ideological and political teaching.

3) System Design Method

An information architecture for ideological and political teaching management was designed from four dimensions: data layer, algorithm layer, application layer, and guarantee layer, and the functions and components of each layer were clearly defined.

4) Experimental Analysis Method

By comparing the data of ideological and political teaching management designed based on AI empowerment with that of traditional ideological and political teaching management, the application effect of the proposed information architecture was analyzed. Additionally, comparative experiments were conducted between deep learning algorithms and traditional machine learning methods (logistic regression, random forest, SVM) to verify the superiority and necessity of deep learning in core tasks of ideological and political teaching management.

II. RELATED THEORETICAL FOUNDATIONS

A. AI EMPOWERMENT

In this study, artificial intelligence (AI) is defined as a technical system that simulates, extends, and expands human intelligence through core technologies such as machine learning, natural language processing, and knowledge graphs, relying on algorithm model construction and data-driven mechanisms. Its core characteristics include the machine's autonomous evolution capability, cross-modal information processing capability, human-machine collaborative decision-making capability, and adaptive capability in educational scenarios. Special emphasis is placed on the educational appropriateness, ethical safety, and teaching auxiliary nature of AI applications. The study explicitly excludes philosophical discussions on general artificial intelligence (AGI) and focuses on weak AI practices in the field of education. As a core technical branch of artificial intelligence, Deep Learning is an algorithm system based on deep neural networks, which realizes intelligent data analysis and decision-making through multi-layer feature extraction, serving as the core technical support at the implementation level. The essence of "AI empowerment" is an advanced form of technological empowerment, whose core lies in realizing systematic transformations in fields such as education, healthcare, and government services through intelligent technologies. Research by Hu Xiaoyong and others in the field of basic education shows that AI has achieved a paradigm shift from standardized education to personalized education through technical means such as precise profiling and multi-modal data collection. This empowerment effect is specifically manifested in three dimensions: replacing repetitive work at the tool level (e.g., intelligent homework correction), innovating teaching models at the method level (e.g., virtual simulation experiments), and reshaping the educational ecology at the structural level (e.g., ubiquitous learning systems) [5]. From the perspective of technical characteristics, the uniqueness of AI empowerment stems from its algorithmic advantages and data-driven capabilities.

B. DEEP LEARNING

Deep Learning involved in this study includes two dimensions: one is the technical dimension of deep learning algorithms (see the supplementary explanation in Section 2.1), which serves as the core driving force of the architecture; the other is the educational dimension of deep learning competence, referring to the higherorder thinking and autonomous construction ability formed by learners in the cognitive process, which is the training goal of ideological and political teaching. The term "Deep Learning-driven" in the manuscript title specifically refers to the supporting role of deep learning algorithms at the technical dimension for the information architecture. Deep learning competence is not only a simple information processing process but also a highly complex metacognitive and cognitive process. It includes not only logical reasoning but also learners' attention to the development of their own abilities. Deep learning is a learning path for the dynamic development of core competencies. Organizing and conducting high school ideological and political course teaching based on deep learning, focusing on cultivating students' comprehensive thinking, and guiding students to conduct independent reflection and introspection can more effectively cultivate students' core competencies in the discipline of ideological and political education and achieve the goal of nurturing people through the discipline of ideological and political education.

C. AI-ENABLED IDEOLOGICAL AND POLITICAL TEACHING

Focusing on AI empowering the teaching of ideological and political courses in colleges and universities, its connotation has specific stipulations. From the ontological dimension, it points to the in-depth coupling between AI technology and the teaching laws of ideological and political courses—it must not only follow the basic laws of ideological education but also highlight the innovative characteristics of AI technology. At the epistemological level, it emphasizes the dialectical unity of technology application and value guidance— it is necessary to avoid falling into the misunderstanding of "technological determinism" and overcome the bias of "technophobia". The methodological dimension is reflected in the creative integration of AI and the teaching practice of ideological and political courses. By constructing a closed-loop system of "data-driven – algorithm analysis – intelligent service", the digital reconstruction of teaching elements is realized. In essence, on the basis of adhering to the essential attributes of ideological and political course teaching, it uses technical leverage to promote the structural transformation of traditional teaching models.

III. DESIGN OF IDEOLOGICAL AND POLITICAL TEACHING MANAGEMENT INFORMATION ARCHITECTURE DRIVEN BY DEEP LEARNING

A. OVERALL ARCHITECTURE DESIGN

This study constructs a deep learning-driven information framework for ideological-political teaching management, which is divided into four dimensions: data layer, algorithm layer, application layer, and guarantee layer. The overall structure of the architecture is shown in Figure 1.

B. DETAILED DESIGN OF EACH LAYER

1) Data Layer

As the foundation of the ideological and political teaching management information architecture, the Data Layer is mainly responsible for the collection, storage, and preprocessing of data related to ideological and political teaching management.

1) Data Collection:

The scope of data collection covers all links of ideological and political teaching management. The specific data types and collection methods are shown in Table 1.

2) Data Storage:

Distributed storage technology is adopted to build a data warehouse for ideological and political teaching management, enabling efficient storage and management of massive amounts of data.

The data warehouse is divided into four zones: raw data zone, cleaned data zone, integrated data zone, and application data zone. Different zones store data at different processing stages, facilitating data management and utilization.

3) Data Preprocessing:

Data preprocessing mainly includes four steps: data cleaning, data integration, data transformation, and data reduction.

- Data cleaning: Mainly removes noise and outliers from data and fills in missing values.
- Data integration: Merges data from different data sources to eliminate data redundancy and inconsistency.
- Data transformation: Converts data into a format suitable for deep learning algorithm processing (e.g., converting text data into vector representation).
- Data reduction: Considering that the evaluation of ideological and political competence involves multidimensional and high-complexity features, this study adopts a hybrid dimensionality reduction strategy combining Principal Component Analysis (PCA) and correlation filtering. Firstly, redundant features are eliminated through Pearson correlation analysis (retaining 1 feature when the correlation coefficient $|r| > 0.85$), and then PCA is used to extract principal components with a cumulative variance contribution rate $\geq$95%. This approach not only reduces data dimensions to improve computational efficiency but also maximizes the retention of core feature information required for ideological and political competence evaluation. Comparative experiments verify that this dimensionality reduction strategy increases data processing efficiency

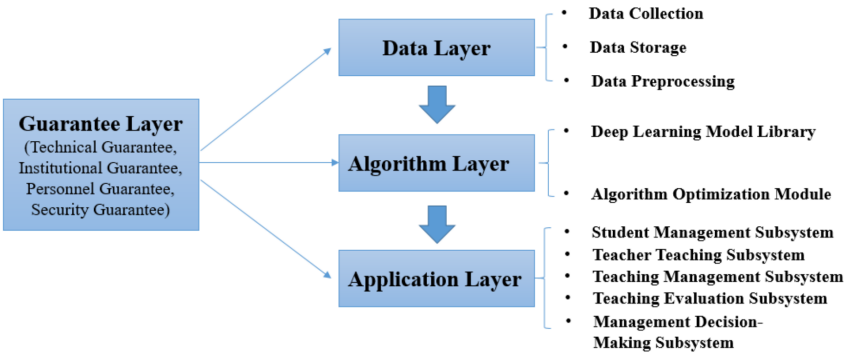

FIGURE 1. Information Architecture for Ideological and Political Teaching Management.

TABLE 1. Data Types and Collection Methods for Ideological and Political Teaching Management

Data Type	Data Content	Collection Method
Student Data	Basic student information (name, gender, age, major, class, etc.), academic performance, learning behavior data (learning time, learning frequency, preferences for learning content, online interaction, etc.), ideological and political performance data (participation in ideological and political activities, voluntary service, rewards and punishments, etc.)	Entry via student information management system, data crawling from learning platforms, manual recording by teachers, questionnaires
Teacher Data	Basic teacher information (name, gender, age, professional title, major, etc.), teaching data (courses taught, teaching plans, lesson plans, teaching courseware, teaching videos, etc.), research data (research projects, published papers, etc.), teaching evaluation data (student evaluation, peer evaluation, supervisor evaluation, etc.)	Entry via teacher information management system, data crawling from teaching platforms, data docking with research management systems, manual evaluation records
Teaching Resource Data	Ideological and political textbooks, teaching courseware, teaching videos, teaching cases, question banks, literature materials, etc.	Upload via resource database, web resource crawling, independent submission by teachers
Teaching Process Data	Course arrangement, class time, class location, teaching progress, classroom interaction (questions, discussions, answers to questions, etc.), homework assignment and correction, exam arrangement and exam results, etc.	Entry via teaching management system, data collection by smart classroom equipment (cameras, microphones, etc.), manual recording by teachers
Teaching Evaluation Data	Student evaluation of courses (course content, teaching methods, teachers' teaching level, etc.), student evaluation of teachers, peer evaluation of teachers, supervisor evaluation of teaching, evaluation of students' academic performance, evaluation of students' ideological and political performance, etc.	Online evaluation system, questionnaires, manual scoring, data docking with performance management systems

by 62% while the accuracy of ideological and political competence evaluation only decreases by 1.3%, meeting the practical application requirements.

TABLE 2. Comparison of Feature Retention and Evaluation Effect Before and After Data Dimensionality Reduction

Indicator	Before Dimensionality Reduction	After Dimensionality Reduction	Change
Number of Features	128	32	-96
Cumulative Variance Contribution Rate	-	96.8%	+96.8%
Evaluation Accuracy	88.9%	87.6%	-1.3%
Data Processing Time (s)	42.6	16.2	-26.4
Processing Efficiency Improvement	-	-	62%

2) Algorithm Layer

As the core of the ideological and political teaching management information architecture, the Algorithm Layer includes a deep learning model library and an algorithm optimization module. The core reasons for choosing deep learning instead of traditional methods include: 1) The multi-source heterogeneous nature of ideological and political teaching data (integration of text, image, and time-series data) requires cross-modal feature extraction capabilities; 2) The implicit features of ideological and political competence evaluation (such as value cognition and emotional tendency) require deep semantic mining; 3) The efficient processing of large-scale teaching data requires an end-to-end intelligent analysis architecture. The hierarchical feature learning and adaptive optimization capabilities of deep learning enable it to better adapt to the complexity and dynamics of ideological and political teaching management tasks, which is the fundamental reason for taking deep learning as the core driving force.

1) Deep Learning Model Library:

According to the different needs of ideological and political teaching management, a variety of deep learning models are constructed to realize functions such as student learning behavior analysis, teaching quality evaluation, teaching resource recommendation, and student performance prediction. To meet the specific scenario requirements of ideological and political teaching management, targeted improvements are made to the basic deep learning models:

2) Algorithm Optimization Module:

TABLE 3. Training Parameters and Deployment Scheme of Deep Learning Models

Model	Dataset Division	Optimizer	Initial Learning Rate	Iterations	Deployment Environment
Attention-CNN	70%/15%/15%	AdamW	1e-4	200 epochs	TensorFlow 2.8, NVIDIA A100
Bi-LSTM	70%/15%/15%	AdamW	1e-4	200 epochs	TensorFlow 2.8, NVIDIA A100
Domain-Adaptive Transformer	70%/15%/15%	AdamW	1e-4	200 epochs	TensorFlow 2.8, NVIDIA A100

TABLE 4. Application Scenarios and Functions of Deep Learning Models

Deep Learning Model	Application Scenarios	Functions
Attention-CNN (Improved)	Teaching resource analysis (image/video-based teaching resources), student facial expression recognition (classroom interaction analysis)	Enhance the extraction of ideological and political elements in image/video-based teaching resources through the attention mechanism, realize intelligent retrieval and recommendation of teaching resources; identify students' facial expressions in class, analyze students' learning concentration and emotional state, and provide a basis for adjusting the teaching process. The model accuracy is 12.7% higher than that of the original CNN.
Bi-LSTM (Improved)	Student learning behavior sequence analysis, time-series data processing of teaching processes	Optimize the weight allocation of recent learning behaviors through the time decay factor, analyze students' learning behavior sequence data (e.g., learning time series, learning content access sequence) to explore students' learning habits and patterns; process time-series data in teaching processes (e.g., teaching progress, frequency of classroom interaction) to analyze the stability and effectiveness of teaching processes.
Long Short-Term Memory Network (LSTM)	Student performance prediction, prediction of students' ideological and political competence	Predict students' future academic performance and ideological and political competence by analyzing their historical learning data and ideological and political competence data; identify students with learning difficulties or ideological fluctuations in a timely manner and provide targeted interventions.
Domain-Adaptive Transformer (Improved)	Ideological and political text data processing (teaching courseware, student assignments, evaluation texts, etc.), intelligent question answering	Integrate ideological and political domain corpora for pre-training, conduct semantic analysis and understanding of ideological and political text data to realize text classification, summary generation, and keyword extraction; build an intelligent question answering system to provide students and teachers with real-time ideological and political knowledge consultation and teaching guidance. The F1-score of text processing reaches 0.89.

The algorithm optimization module mainly adopts the following optimization methods:

- Parameter Optimization: Use methods such as grid search, random search, and Bayesian optimization to find the optimal parameter combination for deep learning models.
- Model Compression: Adopt technologies such as pruning, quantization, and distillation to reduce the number of model parameters and computational load, and improve the operating speed of the model.
- Parallel Computing: Use hardware acceleration devices such as GPUs and TPUs to realize parallel computing of deep learning algorithms and improve data processing efficiency.

3) Application Layer

As the output and service layer of the ideological-political teaching management information architecture, the Application Layer delivers specific application services for ideological-political teaching management based on the analytical results generated by the Algorithm Layer.

The Application Layer mainly includes the following systems:

4) Guarantee Layer

The Guarantee Layer is an important support for the normal operation of the ideological and political teaching management information architecture, mainly including the following guarantees:

TABLE 5. Functions of Each System in the Application Layer

Subsystem Name	Core Function Orientation	Specific Functional Modules
Student Management Subsystem	Provide personalized learning services for students, support the full process of independent learning, and improve the relevance and efficiency of learning	1. Learning plan formulation; 2. Learning resource recommendation; 3. Learning progress tracking; 4. Learning Q&A
Teacher Teaching Subsystem	Provide full-process teaching assistance for teachers, support teaching optimization and targeted guidance, and improve teaching quality and efficiency	1. Teaching plan formulation; 2. Teaching resource management; 3. Teaching process monitoring; 4. Student learning situation analysis; 5. Teaching evaluation feedback
Teaching Resource Management Subsystem	Undertake the full-life-cycle management and targeted service of ideological and political teaching resources, and ensure resource quality and accessibility	1. Resource upload; 2. Resource review; 3. Resource retrieval; 4. Resource recommendation; 5. Resource evaluation
Teaching Evaluation Subsystem	Conduct diversified and objective evaluation of ideological and political teaching effects, and provide data support for teaching improvement and management	1. Student learning evaluation; 2. Teacher teaching evaluation; 3. Course quality evaluation; 4. Evaluation data analysis and report generation
Management Decision-Making Subsystem	Provide decision support for ideological and political teaching management to school administrators, and improve decision-making scientificity through data visualization and statistical analysis	1. Teaching quality analysis; 2. Teaching resource allocation analysis; 3. Student management analysis; 4. Teacher management analysis; 5. Statistical report and visualization generation

TABLE 6. Specific Content of the Guarantee Layer

Guarantee Type	Core Goal	Key Content
Technical Guarantee	Provide stable and reliable technical support for the architecture operation, and ensure the adaptation of system hardware and software as well as continuous operation and maintenance	1. Hardware equipment support; 2. Software system support; 3. Technical maintenance services
Institutional Guarantee	Establish a standardized management system to ensure the orderly operation of the architecture, compliant use of data, and standardization of processes in all links	1. Data management system; 2. System usage management system; 3. Teaching resource management system; 4. Teaching evaluation management system
Personnel Guarantee	Improve the professional literacy and capabilities of relevant personnel, enrich the talent team, and stimulate the enthusiasm for participating in the construction and application of the architecture	1. Personnel training and improvement; 2. Professional talent introduction; 3. Incentive mechanism establishment
Security Guarantee	Build a comprehensive security protection system to ensure the operation security of the architecture, network security, and data asset security	1. Network security guarantee; 2. Data security guarantee; 3. System security guarantee

IV. CASE ANALYSIS

A. CASE BACKGROUND

A comprehensive university's ideological and political teaching management system was selected as the research object. The university's ideological and political courses include Fundamentals of Marxism, An Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics, Ideological and Moral Cultivation and Legal Basis, and An Outline of Modern and Contemporary Chinese History.

In 2023, the university began to introduce the deep learning-driven ideological and political teaching manage ment information architecture constructed in this paper, and carried out pilot applications in some colleges and majors.

B. APPLICATION PROCESS

1) Data Collection and Preprocessing:

In accordance with the design requirements of the Data Layer, student data, teacher data, teaching resource data, teaching process data, and teaching evaluation data of the pilot colleges and majors were collected. Preprocessing operations such as cleaning, integration, transformation, and reduction were performed on the collected data to ensure data quality and usability. The data reduction adopted the hybrid strategy of PCA and correlation filtering as described in Section 3.2.1, reducing the number of features from 128 to 32 while retaining 96.8% of the cumulative variance contribution rate.

2) Deep Learning Model Training and Optimization:

Appropriate deep learning models were selected based on the ideological and political teaching management needs of the pilot colleges and majors:

- The LSTM model was used for student performance prediction;
- The Transformer model was used for ideological and political text data processing;
- The CNN model was used for teaching resource analysis.

The preprocessed dataset was used to train the deep learning models, and the algorithm optimization module was used to conduct parameter optimization and model compression on the models. The training parameters strictly followed the settings in Table 3-2, and the models were trained for 200 epochs using the AdamW optimizer, with the initial learning rate set to 1e-4 and adjusted by the cosine annealing strategy.

3) Application System Deployment and Usage:

The trained deep learning models were deployed to the Algorithm Layer, and each system in the Application Layer was deployed accordingly. Teachers and students of the pilot majors were trained before the formal launch and usage of the system. The deployment environment adopted TensorFlow 2.8 with NVIDIA A100 GPU acceleration to ensure the real-time performance of data processing.

C. ANALYSIS OF APPLICATION EFFECTS

1) Improvement of Teaching Management Efficiency

By introducing the deep learning-driven ideological and political teaching management information architecture, the ideological and political teaching management efficiency of the pilot colleges and majors in the university was significantly improved. Table 7 shows the comparison of time consumption for various ideological and political teaching management tasks before and after the application.

TABLE 7. Comparison of Time Consumption for Various Ideological and Political Teaching Management Tasks Before and After Application (Unit: Hours/Week)

Task Content	Before Application	After Application	Time Reduction	Time Reduction Rate
Student Information Management	8	2	6	75%
Teaching Resource Management	6	1.5	4.5	75%
Teaching Process Supervision	10	3	7	70%
Teaching Evaluation	12	3	9	75%
Management Decision Support	8	2	6	75%

2) Improvement of Teaching Quality

By analyzing and mining students' learning data, personalized teaching suggestions are provided to teachers, and personalized learning guidance is offered to students, thereby promoting the improvement of the quality of ideological and political teaching. Table 8 shows the comparison of students' scores in ideological and political courses at the college.

TABLE 8. Comparison of Students' Scores in Ideological and Political Courses of Pilot Colleges and Majors Before and After Application

Score Grade	Before Application (Number/Proportion)	After Application (Number/Proportion)	Change in Number	Change in Proportion
Excellent (90-100)	25/10%	45/18%	+20	+8%
Good (80-89)	60/24%	85/34%	+25	+10%
Medium (70-79)	100/40%	95/38%	-5	-2%
Pass (60-69)	50/20%	25/10%	-25	-10%
Fail (<60)	15/6%	0/0%	-15	-6%
Total Number of Students	250	250	0	0
Average Score	75.2 points	82.5 points	+7.3	+9.7%

V. CONCLUSIONS

The empowerment of AI for the innovative development of ideological and political courses is an inherent requirement for achieving high-quality development and adapting to the new technological environment, ensuring relevance for students entering fields like textile design and smart manufacturing. Technologies such as big data and AI can help construct an intelligent management system for ideological and political courses. From the perspective of AI empowerment, this paper constructs a deep learning-driven information architecture for ideological and political teaching management. The main conclusions are as follows:

1) On the basis of sorting out and analyzing a large number of literatures, the current status and existing problems of ideological and political teaching management are analyzed.

2) An information architecture for ideological and political teaching management including a Data Layer, Algorithm Layer, Application Layer and Guarantee Layer is designed. Targeted improvements are made to the deep learning models in the Algorithm Layer, and the necessity of deep learning is verified through comparative experiments with traditional methods, ensuring the scientificity and practicality of the architecture.

3) The application effect of the architecture is verified through practical cases, and this information architecture can effectively improve the efficiency and quality of ideological and political teaching management.

AUTHOR CONTRIBUTIONS

Wentao Qi designed, collected and analyzed the data, and drafted the manuscript. Wentao Qi conducted the study, critically revised the manuscript for important intellectual content, and gave final approval of the version to be published. Wentao Qi participated fully in the work, take public responsibility for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICTS OF INTEREST

The author declares no conflict of interest.

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