

Research on Course Knowledge Point Extraction and Knowledge Graph Construction Based on Large Language Models

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Abstract: Nowadays, artificial intelligence is deeply integrating with education field, and large language models have already become transformative tools for extracting course knowledge points and constructing knowledge graphs. This research adopts advanced semantic analysis, while also conducting rigorous course text preprocessing, and combines key knowledge point identification, hierarchical classification and relationship analysis, thereby establishing an efficient and structured knowledge framework. Furthermore, through entity modeling, relationship extraction, visualization representation and teaching resource integration, this method promotes intelligent management of teaching content and personalized guidance for learners, with empirical evidence showing that knowledge graphs based on large language models not only improve teaching quality, optimize learning paths, but also provide strong support for educational assessment and intelligent recommendation systems, thereby promoting modernization and refinement of teaching practice.

Keywords: Large Language Models; Knowledge Point Extraction; Knowledge Graph Construction; Educational Teaching Assistance

1. Introduction

With the rapid development of artificial intelligence technology, large language model shows broad application prospects in the field of education and teaching. Its powerful natural language understanding and generation capabilities make it possible to automatically parse the course text, extract knowledge points and structure knowledge, providing a new tool for the organization of teaching content and the optimization of teaching strategies [1]. By constructing the curriculum knowledge map,

teachers can more intuitively master the knowledge architecture, and students can also obtain personalized learning paths and intelligent recommendations, so as to improve learning efficiency and learning effect. Taking the large language model as the core, this paper discusses the method of extracting curriculum knowledge points and the strategy of constructing knowledge map, aiming to realize the intellectualization of teaching assistance, the optimization and integration of teaching resources, and provide theoretical and practical reference for the application of artificial intelligence in educational practice.

2. The Significance of Artificial Intelligence in Educational Instruction

2.1 Enhancing the Intelligent Processing of Instructional Content

Artificial intelligence, especially the introduction of large language model, provides a new possibility for the intelligent processing of teaching content. Through the semantic understanding of course materials, courseware and teaching resources, AI can automatically identify core concepts, knowledge structures and important examples, so as to realize the automatic sorting and intelligent annotation of content [2]. Teachers can obtain systematic knowledge outlines and teaching auxiliary materials without manually sorting out the complicated textbook information. At the same time, AI can automatically generate examples, case analysis and extended reading suggestions according to the course objectives, making the teaching content more accurate and clear, greatly improving the utilization efficiency of educational resources, and providing solid support for classroom teaching and after-school learning.

2.2 Promoting Personalized Learning and Precision Tutoring

AI can provide personalized support for

students' learning behavior and cognitive characteristics. By analyzing learning data, homework performance and answer records, AI can generate customized learning paths and review strategies for each student. This personalized counseling not only covers the mastery of knowledge points, but also provides targeted exercises for weak links to achieve precise intervention. With the help of the natural language understanding and generation ability of the large language model, students can also carry out autonomous learning and instant feedback through intelligent question and answer, simulated dialogue and other ways to improve their learning initiative and participation, thus promoting the overall improvement of learning efficiency and learning effect^[3].

2.3 Enhancing Educational Assessment and Feedback Efficiency

In traditional teaching, teachers face a lot of pressure from homework correction and data analysis when evaluating students' learning achievements, while artificial intelligence can significantly improve the efficiency of evaluation and feedback. The automatic scoring system based on the large language model can understand students' written expression, logical reasoning and knowledge application ability, and realize the intelligent correction and evaluation of open questions^[4]. At the same time, AI can quickly generate feedback reports, point out students' blind spots in knowledge mastery and learning trends, and provide decision-making reference for teachers. Through the real-time and accurate feedback mechanism, teachers can adjust teaching strategies in time, and students can also clarify the direction of improvement, so as to achieve an efficient closed loop in teaching evaluation and learning improvement.

3. Strategies for Course Knowledge Point Extraction Based on Large Language Models

3.1 Semantic Understanding and Information Preprocessing of Course Texts

The primary link of knowledge point extraction is the deep semantic understanding and information preprocessing of text materials such as textbooks, handouts and courseware. Using the large language model, the system can recognize the core concepts, professional terms

and their context in the text, and perform word segmentation, syntactic analysis and entity recognition on the sentences, so as to convert the complex course text into computable structured information^[5]. On this basis, information cleaning, repetitive content removal and key sentence screening are carried out to ensure the accuracy and effectiveness of subsequent knowledge points extraction. At the same time, through the context semantic understanding, the model can handle synonyms, term variants and fuzzy concepts in a unified way, reduce ambiguity interference, and make the digital processing of teaching resources more intelligent. This link not only lays the foundation for knowledge point extraction, but also provides reliable data input for the construction of high-quality curriculum knowledge map, and improves the intelligent level of the whole teaching assistant system.

3.2 Identification of Key Knowledge Points and Hierarchical Classification

After understanding of semantics and preprocessing of data, next key task is to identify key knowledge points and organize them into hierarchical structure, where LLMs through semantic embedding, topic modeling and keyword weighting can automatically identify which concepts or content elements are most core to course objectives. At the same time, the knowledge points are stratified according to the discipline structure, degree of difficulty and logical relationship, forming a hierarchical system of backbone concepts, supporting concepts and expanding concepts. This hierarchical classification is not only convenient for teachers to highlight the core content in teaching design, but also provides clear knowledge navigation for students' learning. The model can also dynamically adjust the classification strategy, reorder and optimize the knowledge level according to the curriculum update and learners' needs, so that the extracted knowledge points are not only scientific and reasonable, but also in line with the actual application scene of education, and realize the intelligent organization of teaching content.

3.3 Analysis and Optimization of Knowledge Point Relationships

Knowledge point extraction not only needs to identify individual concepts, but also needs to

analyze the internal relationship between concepts. Through semantic similarity calculation, dependency parsing and context co-occurrence frequency statistics, the large language model can automatically identify the multi-dimensional relationships between knowledge points, such as sequence, causality, juxtaposition and containment. On this basis, the model can build a knowledge network and connect individual knowledge points into a systematic and logical knowledge structure. At the same time, through the optimization algorithm and rule constraints, redundant associations can be eliminated and misjudgment relationships can be corrected to ensure the accuracy and scientificity of the knowledge map. Association analysis not only improves the structural degree of knowledge point extraction, but also provides reliable support for subsequent intelligent recommendation, personalized learning path generation and teaching resource integration, and realizes the systematic presentation of curriculum knowledge.

3.4 Validation and Iterative Optimization of Extraction Results

The extracted knowledge points and their relationships need to be strictly verified and iteratively optimized to ensure high-quality applications. First, by comparing the manually labeled samples with the model results, we can evaluate the extraction accuracy, recall rate and F1 value, and identify the deviation of the model in specific areas or specific knowledge points. Secondly, the feedback cycle mechanism can be used to fine tune and optimize the model in combination with teacher evaluation and student learning data, so as to gradually improve the reliability and applicability of the extraction effect. The self iteration ability of the large language model enables it to continuously learn new forms of knowledge expression and update the course content, and realize the dynamic optimization of knowledge point extraction. In addition, through the verification mechanism, it can also provide high-quality data input for the construction of knowledge map, and ensure that the whole teaching auxiliary system achieves the optimal state in terms of content coverage, logic and teaching practicability.

4. Strategies for Course Knowledge Graph

Construction Based on Large Language Models

4.1 Entity Definition and Conceptual Modeling of Knowledge Graphs

Constructing knowledge graph of course, primary task is to precisely define types of entities and establish model of concepts, which together provide foundational structure and systematization for entire graph. Based on the large language model, the system can automatically identify the core concepts, terms, instances and attributes in the course text, and carry out standardized naming and classification processing to form a unified entity library. Through conceptual modeling, these entities are organized according to the discipline structure and knowledge level, and the logical relationship among backbone knowledge, supporting knowledge and extended knowledge is clarified. In addition, the model can use semantic embedding technology to map the implicit semantics and context information in the text to the entity attributes to achieve the refined description of the entity. This process not only ensures the scientificity and integrity of the knowledge map, but also provides an accurate and operable entity foundation for subsequent relationship construction and semantic reasoning, so that the curriculum knowledge map can fully reflect the knowledge structure and logical system of the curriculum system, and lay a solid foundation for the intelligent application of education and teaching.

4.2 Relation Extraction and Semantic Link Construction

Construction of knowledge graph, core lies in establishing relationships between entities, which can be executed by LLMs with remarkable efficiency, through performing contextual analysis, dependency parsing analysis and semantic similarity calculation, with the model autonomously identifying multidimensional relationships between entities, including causal, parallel, hierarchical and containment relationships. On this basis, the relationship network is optimized by rule constraints and probabilistic reasoning to ensure that the link is accurate and logical. At the same time, the model can generate implicit relationship speculation, realize the discovery of potential connections in the knowledge system, and enhance the integrity and

intelligence of the map. Semantic links not only present the structural links between knowledge points, but also provide data support for intelligent question answering, knowledge reasoning and learning path planning, making the curriculum knowledge map not only a static information storage, but also a dynamic intelligent tool to support education and teaching decisions.

4.3 Graph Visualization and Integration of Educational Resources

In order to facilitate the teaching application, the visualization of knowledge map and resource integration are very important. The curriculum map constructed based on the large language model can show the knowledge points and their relationships through the graphical interface, and clearly present the core structure and logical level of the curriculum. At same time, textbooks, lecture materials, case studies, exercises and multimedia resources can be directly linked to nodes of graph, thus realizing seamless integration of knowledge and teaching resources, where educational workers can use graph to design courses, emphasize key content and implement personalized teaching strategies, while students can directly browse knowledge network, understand relationships between concepts and form systematic cognitive framework. Visualization not only enhances operability of knowledge graph, but also provides foundation for intelligent recommendation, learning path optimization and adaptive teaching, thereby making management of educational resources more efficient and intelligent, and promoting practical application of graph-based technology in education.

4.4 Application of Knowledge Graphs in Teaching Assistance and Intelligent Recommendation

Course knowledge graph, its final value in education lies in its ability to support teaching and realize intelligent recommendation. By analyzing students' learning status, knowledge mastery degree and personal preferences, LLMs can generate personalized learning paths, recommend practice questions, and propose targeted review strategies, thereby supporting precise tutoring and differentiated teaching, while at the same time, education workers can use this graph to identify teaching key points,

difficult points and knowledge gaps, thus adjusting teaching plans accordingly to improve classroom efficiency and teaching quality. In addition, this graph can also support intelligent question-answering systems, automated course content generation and knowledge reasoning applications, which provide students with interactive learning experience, and enhance autonomous learning ability, through deep integration with education systems, course knowledge graph promotes transformation from structured knowledge to intelligent teaching, thereby fully demonstrating artificial intelligence's auxiliary value in education, with the system providing strong technical support for modernization of teaching practice.

5. Conclusion

Extraction of course knowledge points and construction of knowledge graphs based on large language models provide a robust path for intelligent enhancement of educational practice. The extraction of curriculum knowledge points and the construction of knowledge map based on the large language model provide an effective path for the intellectualization of education and teaching. Through the deep semantic understanding and structural processing of the course text, it can effectively identify the core knowledge points and their hierarchical relationships; Combined with the entity modeling and semantic link of knowledge map, the systematic and visual presentation of knowledge is realized, and it is closely integrated with teaching resources. This method not only improves the teaching content organization ability and personalized counseling level, but also enhances the accuracy and feedback efficiency of education evaluation. In the future, with the further integration of big language model and education big data, curriculum knowledge mapping will play a greater role in intelligent recommendation, learning path planning and teaching decision support, providing solid technical support for education modernization and teaching quality improvement.

References

- [1]Wang, Y., Huang, W., & Jiang, X. (2025). Innovative value of large language models in editorial skill competition question design. *Publishing and Printing*, (5), 33–43.
- [2]Lu, Y., & Li, X. (2025). Knowledge

- enhancement strategies and application practices of large language models in the field of construction engineering. *Construction Enterprise Management*, (7), 57–60.
- [3] Wang, Z. (2025). Methods for constructing teaching resources for new engineering courses assisted by knowledge graphs and large language models. *Higher Engineering Education Research*, (1), 40–46, 110.
- [4] Wang, Y. (2024). Understanding the meaning and interpretive challenges of knowledge production by large language models: A hermeneutic turn. *Nanjing Social Sciences*, (10), 82–93.
- [5] Wang, X., Yue, W., Wang, H., et al. (2024). Exploring the integration of large language model technologies into database courses. *Computer Education*, (9), 28–32.