Design and Implementation of an Ontology-Based Prototype System for Citation Knowledge Services (Postprint)

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Abstract

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[Method/Process] Taking citation data as the research object, this study acquires and organizes the various types of knowledge involved, explores semantic relationships between citations, constructs two ontologies—a researcher ontology and a citation knowledge ontology—and designs and preliminarily implements a citation knowledge service prototype system.

[Results/Conclusion] The construction of the ontology-based citation knowledge service prototype system was validated, and experimental results show that the ontology-based citation knowledge service prototype system essentially achieves the predetermined goals and functions.

Full Text

Preamble

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Design and Implementation of an Ontology-based Citation Knowledge Service Prototype System

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Abstract

[**Purpose/Significance**] Currently, domestic citation database construction has begun to take shape, but existing citation knowledge service systems cannot adequately reveal the structure or relationships between citations, creating difficulties for citation acquisition, sharing, and utilization. [**Method/Process**] This study takes citation data as its research object, acquires and organizes various types of knowledge involved, explores semantic relationships between citations, constructs two ontologies—a researcher ontology and a citation knowledge ontology—and designs and preliminarily implements a citation knowledge service prototype system. [**Result/Conclusion**] The construction of the ontology-based citation knowledge service prototype system is validated, and experimental results demonstrate that the system basically achieves its predetermined goals and functions.

Keywords: ontology, knowledge service, prototype system, citation
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Introduction

Among billions of knowledge resources, scientific literature serves as a crucial pathway for researchers to acquire knowledge and understand research trends, representing an important carrier of knowledge dissemination. Currently, domestic organization of scientific literature lacks unified standards and intelligent organization tools, while also neglecting hierarchical processing of scientific literature resources. Although domestic citation database construction has begun to take shape and is widely used, the current organization and retrieval methods of scientific literature resources prevent existing citation knowledge service models from effectively revealing citation structures or relationships, creating certain difficulties for citation acquisition, sharing, and utilization.

2. Related Research Review

Domestic research on knowledge services began as early as 2000, when Mr. Zhang Xiaolin presciently noted in his article "Towards Knowledge Services: Finding Growth Points for Library and Information Work in the New Century" that the dual impact of the emerging knowledge economy and network digitization required not only transforming library and information systems based on modern technology and providing information services with broader and richer resources, but also re-examining the requirements of the knowledge economy and modern information environment for library and information work, and re-positioning core competencies and breakthrough points for growth. In June 1999, the China National Knowledge Infrastructure (CNKI) project—China Knowledge Network—was jointly initiated by Tsinghua University and Tsinghua Tongfang. Other large-scale literature knowledge service systems include the China Engineering Science and Technology Knowledge

Center and Wanfang Data.

International research on knowledge services emphasizes practice, having formed relatively rich theoretical and practical outcomes. Early knowledge service system developments include the U.S. National Library of Medicine's Medical Literature Analysis and Retrieval System and the U.S. National Center for Biotechnology Information's biological information databases. If we broaden the definition of knowledge service systems beyond knowledge databases and encyclopedias, services provided by Wikipedia, Google, and Siri can all be considered knowledge services, differing only in form and depth. Traditional literature knowledge service systems mostly provide simple information retrieval services through keyword matching to achieve correspondence between specific knowledge resources and users. While simple, this approach easily overlooks the semantic dimension of knowledge resources, causing significant loss of semantically-related knowledge resources. Traditional retrieval cannot display citation hierarchies or paths, nor trace their origins and citation processes. Although retrieval results present large amounts of literature, they cannot well satisfy users' personalized knowledge needs.

Today, people are no longer interested solely in knowledge resources themselves, but pay more attention to semantic associations between them. However, current domestic scientific literature resource organization models remain overly simple and singular, unable to achieve semantic retrieval. As ontology technology continues to develop, the concept of ontology has gradually been applied to knowledge services, but research on citation knowledge services remains scarce, and few scholars have organically combined it with ontology systems to mine potentially valuable information by revealing citation structures and semantic relationships, explore semantic relationships between citations, and understand citation paths, thereby enhancing semantic expression of knowledge. Ontology provides excellent conceptual hierarchical structures that can fully reveal internal relationships within knowledge resources. Applying ontology to build citation knowledge navigation subsystems can display both relationships between resources and internal resource attributes. Compared with linear knowledge organization in traditional classification navigation, ontology-based citation knowledge navigation subsystems emphasize not only conceptual hierarchical relationships but also revealing internal associations within knowledge resources, forming network structures that enable faster knowledge searching and more precise positioning.

3. Functional Design of the Ontology-based Citation Knowledge Service Prototype System

3.1 Functions of the Ontology-based Citation Knowledge Service Prototype System

Scientific literature serves as an important carrier for researchers to acquire knowledge, and structured knowledge organization is key to ensuring knowl-

edge service quality. Research on citation knowledge services can help users locate and obtain citation data while understanding citation paths, thereby promoting data sharing and reuse. This study constructs an ontology-based citation knowledge service prototype system, introduces semantic relationships and the concept of ontology to improve citation knowledge service quality, and reveals citation structures or relationships to a certain extent. According to the levels, structures, and functions that literature needs to represent, the system integrates literature knowledge elements and units into a rule-based knowledge system, transforming seemingly disorganized knowledge into an ordered knowledge network. As a complete and clear knowledge representation method, ontology extends knowledge representation to the semantic level, achieving semantic-level representation of knowledge resources. This study investigates the ontology-based citation knowledge service prototype system, constructs two ontologies—a researcher ontology and a citation knowledge ontology—and validates the system construction, including ontology-based knowledge navigation, citation hierarchy display, citation path display, peer citation display, and citation knowledge recommendation modules.

The prototype system provides functions such as knowledge display, retrieval, browsing, navigation, and recommendation based on a citation knowledge base, enabling users to more conveniently acquire needed knowledge. This paper aims to construct a citation knowledge service prototype system, ultimately forming a citation knowledge service prototype system platform with multiple knowledge service functions including semantic retrieval, knowledge navigation, and knowledge recommendation, providing new ideas for existing library knowledge services. The system includes three subsystems: citation knowledge navigation, citation knowledge retrieval, and citation knowledge recommendation.

3.2 Citation Knowledge Navigation Subsystem

The citation knowledge navigation subsystem primarily uses the researcher ontology for classification navigation, employing hierarchical structures to reveal resource relationships from the perspective of internal association characteristics. Ontology fully supports logical reasoning and possesses excellent conceptual hierarchical structures. Applying ontology to build citation knowledge navigation subsystems can display both relationships between resources and internal resource attributes. Compared with linear knowledge organization in traditional classification navigation, ontology-based citation knowledge navigation subsystems emphasize not only conceptual hierarchical relationships but also revealing internal associations within knowledge resources, forming network structures that enable faster knowledge searching and more precise positioning.

This study selects the researcher ontology to build the citation knowledge navigation subsystem, presenting researcher relationships to users in a hierarchical structure. The citation knowledge navigation subsystem is divided into left and right modules. The left module is a personnel directory, displaying all relevant researchers through a tree structure with each researcher arranged according

to hierarchical levels. Users can select researchers of interest and click through layers to understand associations such as students and peers. In the right module, users can obtain personal information for the selected researcher from the database (including name, birth date, research institution, position, research field, funded projects, etc.), publication status, citation status, frequently used keywords, and publications, with the prototype system dynamically displaying related knowledge.

3.3 Citation Knowledge Retrieval Subsystem

The ontology-based citation knowledge retrieval subsystem organizes citation materials through the researcher ontology and citation knowledge ontology, performs semantic indexing of literature resources, and conducts knowledge classification, indexing, description, and processing of resource objects to form machine-understandable metadata with semantics, thereby achieving ontology-based knowledge retrieval. Existing knowledge retrieval typically presents only direct knowledge needs to users, lacking presentation of semantic associations, and the organization model of scientific literature resources remains overly simple and singular. However, in the ontology-based citation knowledge retrieval subsystem, besides accurately matching knowledge according to user needs, the system can also output citation hierarchies and citation levels of retrieved literature, making citation relationships and paths clear at a glance. Additionally, semantic reasoning is used to display mutual citation relationships between peers and within academic lineages [Figure 1: see original paper].

First, users submit retrieval requests. The system preprocesses the retrieval expression, encapsulates required keywords into node objects (the retrieval formula is converted into a specific format understandable by the system), and transmits the retrieval formula from the functional layer to the logical layer. The retrieval formula then undergoes semantic expansion and reasoning to transform into a new retrieval formula. Next, the system queries the encapsulated nodes, maps them with the ontology library, performs knowledge extraction, and correctly outputs results. Finally, the output results are sorted and transmitted back to the functional layer for presentation on the user interface.

3.4 Citation Knowledge Recommendation Subsystem

Ontology is an explicit formal specification of conceptualization primarily used to establish knowledge models about user backgrounds, item knowledge, and domain knowledge. In the ontology-based citation knowledge recommendation subsystem, ontology is used for knowledge representation. As online learning resources grow exponentially on the World Wide Web, learners face information overload and struggle to select the most suitable materials to meet their needs. With the advent of the Internet, selecting useful information from the ocean of data has become a major challenge due to information overload. Citation recommendation can automatically recommend the most relevant citation resources to users based on their personal preferences and profiles, overcoming these prob-

lems. Unlike traditional search engines and retrieval systems that return results matching user queries, recommendation systems tailor personalized suggestions to user needs and preferences, playing important roles in e-commerce and e-learning.

The main goal of the citation knowledge recommendation subsystem is to help users find useful knowledge that meets their needs. Traditional recommendation systems are typically rating-based user recommendation systems. In this designed citation knowledge recommendation subsystem, additional information such as user characteristics is used for personalized recommendations. B. Vesin et al. noted that e-learning recommendation systems need to consider learners' specific requirements, making consideration of specific user characteristics increasingly important. K. Verbert et al. emphasized the importance of incorporating additional information about learners and instructors during the recommendation process, suggesting that using knowledge structures like ontologies to personalize learner profiles can reduce the complexity of learning resource recommendations according to learners' needs and characteristics.

The citation knowledge recommendation subsystem recommends related papers or frequently cited papers to users based on their interests in specific researchers. The subsystem also recommends papers published by the instructors, students, or peers of researchers of interest to users. Furthermore, the subsystem presents recommendation results in diverse ways such as lists and graphics, fully demonstrating correlations between papers and between authors and papers, and enhancing the interactivity of the prototype system.

4. Key Technologies of the Ontology-based Citation Knowledge Service Prototype System

4.1 Construction of Researcher Ontology Knowledge Base

The ontology-based citation knowledge service prototype system provides broad development space for knowledge sharing, continuously mining new knowledge and promoting knowledge association. The purposes of constructing the researcher ontology are fourfold: 1) Provide visualization functions for researcher-related information. This paper takes Professor Ma Feicheng as an example to create researcher ontology instances, forming relevant knowledge links centered on Professor Ma Feicheng, involving personal profiles, research relationships, research fields, publications, and other information. 2) Provide certain semantic retrieval functions. One goal of building the personnel relationship ontology is to enhance user experience by providing semantic retrieval functions alongside visualization to better meet user needs. 3) Provide knowledge navigation functions. By applying ontology technology to build researcher navigation modules for visual presentation, researchers and their related papers are presented according to certain associations and hierarchical structures. 4) Provide semantic reasoning and knowledge mining functions. Mining explicit and implicit knowledge is an important goal of the ontology-based citation knowledge service

prototype system, such as displaying mutual citations among peers and within academic lineages.

4.1.1 Collection and Organization of Researcher Elements This paper establishes the researcher ontology using Professor Ma Feicheng as an example. Researcher relationship data is also collected and organized around Professor Ma Feicheng. Data collection for Professor Ma Feicheng is conducted from three aspects:

1. **Basic Information**: Basic personal information is primarily referenced from Professor Ma Feicheng's profile listed on the official website of Wuhan University School of Information Management, including name, birth date, gender, position, research institution, research field, courses taught, research projects, and social appointments.
2. **Personnel Relationships**: Through collection and organization of personnel relationships, the citation relationships and co-authorship relationships of individuals' papers can be fully displayed. Personnel relationships mainly include three types: student, advisor, and colleague. Data on students, advisors, and peers is primarily collected from the catalog of doctoral and master's theses published by Wuhan University School of Information Management, while colleague relationship data is referenced from the faculty webpages published on the school's official website.
3. **Publications**: Data on Professor Ma Feicheng's publications is sourced from the CSSCI citation database. Using the "author" field with "Ma Feicheng" as the search term, 153 documents were retrieved. The bibliographic information and citation information of these documents were then downloaded and saved to the database. To display more citation relationships and other associations, bibliographic and citation information for researchers such as Li Gang (Professor Ma Feicheng's student and colleague), Zha Xianjin (student and colleague), Luo Lin (student and colleague), and An Lu (Professor Li Gang's student and colleague) were also downloaded from the CSSCI database and imported into the database.

4.1.2 Determination of Core Concept Set Through analysis of researcher elements, the core concepts are found to include Person, Event, Time, and Place. When constructing the researcher ontology, this paper focuses on Professor Ma Feicheng as the central figure, fully considering his experiences and achievements, and adds two new classes: Publication and Article. The Person class is the main class of the researcher ontology, while the other five classes are auxiliary classes. The six classes involved in this paper are briefly described as follows: 1) **Person Class**: In this paper, the Person class specifically refers to individuals related to Professor Ma Feicheng, with prominent personal significance. 2) **Event Class**: In this paper, the Event class refers to various activities related to the main figure, associated with Person, Publication, Time,

Place, Article, and other classes. 3) **Publication Class**: In this paper, the Publication class specifically refers to books related to the figure, excluding articles. 4) **Article Class**: In this paper, the Article class refers to articles published by the figure, article citations, and other related materials. 5) **Time Class**: In this paper, the Time class is associated with all other classes, representing when events occur. 6) **Place Class**: In this paper, the Place class refers to where events occur and is associated with all other classes.

4.1.3 Determination of Hierarchical Relationships Between Concepts In the researcher ontology, the Person class is further subdivided into three subclasses: Personal Information, Person Publications, and Related Relationships. Person Publications include Publications and Articles, while Related Relationships include Advisor, Student, and Colleague. Related Relationships include four subclasses: Studying, Teaching, Editorial Board Membership, and Writing. The Publication class refers to relevant publications by the main figure. The Article class includes two subclasses: Journal Article and Master's Thesis, with Journal Articles mapping to the citation knowledge ontology. The Time class is further subdivided into four subclasses based on event occurrence time, graduation time, article publication time, and publication time. If the hierarchical structures of the main and auxiliary classes are further subdivided according to the above levels, a hierarchical model diagram is obtained [Figure 2: see original paper].

4.1.4 Determination of Class Properties Class properties are divided into object properties and data properties. Object properties represent relationships between concepts, either within the same concept or between different concepts. For example, "Person" publishes "Journal Article" represents a relationship between Person and Article; "Student" is an object property of Person, referring to some relationship between two instances of the Person class. Data properties refer to intrinsic properties of concepts, such as "Name" and "Research Field," which describe essential characteristics. A schematic diagram of property settings for the researcher ontology is shown in [Figure 3: see original paper].

4.2 Construction of Citation Knowledge Ontology Knowledge Base

The concept of "citation knowledge ontology" involves extracting citation elements that are easy to understand and have consensus, and constructing a convenient, simple, and machine-readable ontology suitable for traditional citation analysis to better organize, store, and query citation data for knowledge services. The research object of citation knowledge ontology is citation resource metadata. The distributed storage of citation resources makes resource semanticization difficult. Taking Chinese journal citation databases as examples, there are various citation databases including Chinese Social Sciences Citation Index (CSSCI) and Chinese Science Citation Database (CSCD), with different indexing fields and cataloging formats. In this study, the authoritative and high-quality CSSCI database is selected as the data source. The CSSCI citation

database contains 13 indexing fields: source title, source author, English title, journal, fund, institution name, first institution, first author, Chinese Library Classification (CLC) number, volume/issue, keywords, fund category, and references. Based on the principle of effectively preserving semantics, these fields undergo preprocessing operations including unification, merging, and deletion. For example, "First Author" is deleted, "Fund Category" is defined as "Fund," and entities and relationships are transformed into ontology-defined classes and properties [Figure 4: see original paper].

To enrich the functions of the citation knowledge service system, private classes and private properties can be defined according to actual needs. Additionally, a Citation class needs to be defined, adding citation count, cited count, citation details, and cited literature details. When defining the Article class, CLC number, keywords, and article type need to be added. When defining the Fund class, reference is made to the National Social Science Fund project database, further subdividing it into project approval number, project name, project category, project discipline classification, project start time, project leader, and project outcomes. When defining the Journal class, journal homepage information is primarily added. When defining the Institution class, province and institution homepage information are primarily added. The final citation knowledge ontology class system is shown in [Figure 5: see original paper].

4.3 Ontology Data Storage and Mapping

To support upper-level citation knowledge service functions, ontology storage mechanisms can be selected based on data acquisition and invocation performance. Although many professional databases currently support RDF data storage, such as Virtuoso, Jena, and Fuseki, for RDF data association retrieval, complex SPARQL query statements need to be constructed by considering forward and reverse relationship iterations starting from path length 0. When related information becomes complex, query efficiency becomes very low. To implement citation knowledge service functions, this study adopts graph theory thinking and selects a graph database based on graph structures to store the ontology. Only by obtaining multiple nodes and relationship edges can semantic paths between concepts be easily retrieved. Graph databases have more obvious advantages in processing associated data. Graph databases store data through nodes and edges, where entities are represented by nodes and relationships between entities are represented by edges. Currently, commonly used graph databases include Neo4j, Trinity, DEX, InfiniteGraph, HyperGraphDB, and AllegroGraph, among which Neo4j has attracted more attention due to its performance advantages. Neo4j is a type of NoSQL database primarily used to store structured data, forming data networks.

In this study, Neo4j is selected to store the ontology. By constructing Cypher query statements and utilizing graph algorithms such as all paths, shortest path, and longest path provided by Neo4j, relevant functions of citation knowledge services are implemented. When mapping elements from "Ma Feicheng's" personal

information in Neo4j, the resulting structural relationship diagram is shown in [Figure 6: see original paper], displaying relevant personal information elements including research projects, research fields, taught courses, graduation theses, and advisor information. It can be seen that Ma Feicheng's advisor is Yan Yimin, and his peers include Ma Dachuan and Kuang Xinghua.

When all classes, properties, and instances in the personnel relationship ontology are mapped to Neo4j, they are stored in the database in a graphical pattern, allowing visualization of nodes and relationships. [Figure 7: see original paper] shows a schematic diagram of the storage structure for some source literature and cited literature, displaying the citation structure among some of Professor Ma Feicheng's articles.

5. Functional Implementation of the Ontology-based Citation Knowledge Service Prototype System

5.1 Implementation of Citation Semantic Retrieval Function

This study adopts a depth-first search strategy. When users retrieve certain elements of citations, the system outputs corresponding association information according to retrieval requirements.

5.1.1 C-path(x) Semantic Retrieval C-path(x) citation path retrieval refers to semantic retrieval with a starting node as a single node. For example, when users want to query information about the article "A Review of Link Prediction Research in Scientific Knowledge Networks," they can input "科学知识网络中的链路预测研究述评" at the starting node, with retrieval results shown in [Figure 8: see original paper]. A more vivid visualization result can also be obtained, as shown in the visual retrieval sample in [Figure 9: see original paper], which clearly displays related information (such as author, journal information, fund information, keywords, etc.).

5.1.2 Citation Hierarchy and Element Display When given an article, the system outputs citation hierarchies according to user-specified levels, making all citation relationships clear at a glance. For example, if users want to retrieve the article "Construction and Operation of China's National Security Intelligence System" and input "3" in the "Level" field, the retrieval results shown in [Figure 10: see original paper] are obtained. When users click the "Display Tag Cloud" button in the upper right corner, a tag cloud composed of all keywords from all citations of the article appears. Clicking on a tag displays its frequency in citations. For instance, clicking "National Security Strategy" shows that the keyword appears twice [Figure 11: see original paper]. Citation keywords can reflect the themes of cited literature, thereby indicating the theme of the source literature to some extent. The citation tag cloud design helps users more accurately understand the themes of articles of interest and their relationships with other articles.

5.1.3 C-path(x,y) Citation Path Retrieval C-path(x,y) citation path retrieval refers to citation path retrieval between nodes. For example, when users take "Knowledge Network Evolution III: Connection Mechanisms" as the starting node and "Knowledge Network Evolution I: Growth and Aging Dynamics" as the terminating node, with path length set to 2, the retrieval results are shown in [Figure 12: see original paper].

5.1.4 Person Relationship Path Retrieval When users want to understand the relationship between two people, the prototype system can analyze from multiple aspects and angles to help users comprehensively and systematically understand various personnel relationships. This function takes person elements as starting nodes to display semantic path relationships between individuals. For example, if users take "Ma Feicheng" as the starting node and "An Lu" as the terminating node, the person relationship path retrieval results are shown in [Figure 13: see original paper]. Further analysis of these semantic paths reveals the semantic paths between the person elements "Ma Feicheng" and "An Lu." For instance, the last path in [Figure 13: see original paper] can be summarized as: An Lu's article "A Review of Link Prediction Research in Scientific Knowledge Networks" cited Professor Ma Feicheng's article "Structure and Process Models of Knowledge Networks."

5.1.5 Peer Citation Relationship Display Using semantic reasoning functions, the prototype system can display mutual citation relationships among peers and within academic lineages [Figure 14: see original paper]. As shown in [Figure 14: see original paper], when users take "Zhang Bin" as the retrieval object, they can learn that Chen Xiaojun, Li Yating, Su Xiaomin, Zhao Hongbin, Fu Zhenzhen, Wang Juncheng, Liu Xiang, and Wang Xiaoguang are all students of Professor Ma Feicheng. In peer citations, Zhang Bin cited articles published by these individuals. In academic lineage citations, the system displays all articles by Zhang Bin's advisor, Professor Ma Feicheng, that Zhang Bin has cited.

5.2 Implementation of Citation Knowledge Navigation Function

The knowledge navigation interface is the window for user interaction with the citation knowledge service prototype system, with knowledge navigation services primarily implemented through this interface. [Figure 15: see original paper] shows the navigation interface using Professor Ma Feicheng as the starting point. When users click the "Frequently Used Keywords" and "Co-authors" buttons on the right, corresponding tag clouds are displayed [Figure 16: see original paper] and [Figure 17: see original paper]. Tag size depends on keyword frequency—more frequent keywords appear in larger fonts. Clicking on a tag pops up its frequency count.

In the knowledge navigation function interface, various person relationship tags of Professor Ma Feicheng can also be displayed visually [Figure 18: see original

paper].

5.3 Implementation of Citation Knowledge Recommendation Function

In the knowledge recommendation interface, when users retrieve an article, it is saved to their retrieval record. The prototype system then makes recommendations based on this record. The recommendation order is: 1) Articles containing keywords from the user's interested article; 2) Most frequently cited articles from the user's interested article's citations; 3) Other articles by the author of the user's interested article. Articles with higher citation frequencies appear in larger fonts and more prominent positions, helping users find the most relevant articles. The citation knowledge recommendation schematic is shown in [Figure 19: see original paper].

Conclusion

Research on ontology-based citation knowledge services is conducted against the backdrop of increasingly prominent importance of knowledge resources and growing emphasis on knowledge service quality. Scientific literature serves as an important carrier for researchers to acquire knowledge, and structured knowledge organization is key to ensuring knowledge service quality. Research on citation knowledge services can help users locate and obtain citation data while understanding citation paths, thereby promoting data sharing and reuse.

Adhering to the principle of combining theory with practice, this study conducts in-depth research on ontology-based citation knowledge services from multiple aspects including theoretical study, construction of researcher ontology and citation knowledge ontology, knowledge base design and construction, and empirical research. According to ontology construction goals and system requirements, the researcher ontology and citation knowledge ontology are constructed, and their specific construction processes are described. The ontologies are mapped to a graph database, and mapping rules between the ontology and database are provided. The design of the ontology-based citation knowledge service prototype system is completed, implementing various functions including ontology-based knowledge navigation, citation hierarchy display, citation path display, and citation knowledge recommendation. Experimental results demonstrate that the ontology-based citation knowledge service prototype system basically achieves its predetermined goals and functions.

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Author Contribution Statement

Wang Shanshan: Designed the research framework and wrote Chapters 1, 2, and 3;
Chen Chen: Participated in research design, validated research results, and wrote Chapters 4, 5, and 6;

Xiao Ming: Participated in research and revised the paper.

Design and Implementation of Ontology-based Citation Knowledge Service Prototype System

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Abstract: [Purpose/significance] Currently, the construction of domestic citation databases has begun to take shape. In the development of citation knowledge services, the current organization and retrieval methods of scientific literature resources make existing citation knowledge service models unable to well reveal the structure or relationships between citations, causing difficulties for citation acquisition, sharing, and utilization. [Method/process] This paper takes citation data as the research object, acquires and organizes various types of knowledge involved, explores semantic relationships between citations, constructs two ontologies named "scientific researcher ontology" and "citation knowledge ontology," and designs and implements an ontology-based citation knowledge service prototype system. [Result/conclusion] Empirical research is conducted on the construction of the ontology-based citation knowledge service system. Results prove that the ontology-based citation knowledge service system has the expected goals and functions.

Keywords: ontology; knowledge service; prototype system; citation

Note: Figure translations are in progress. See original paper for figures.