Knowledge Fusion System Architecture Design for Government Website Information Resources (Postprint)

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Abstract

[Purpose/Significance] From the perspective of knowledge fusion, this study addresses the contradiction between the decentralized and massive nature of government website information resources and the public's demand for complete and precise knowledge, thereby providing users with more effective decision support and improving the utilization efficiency of government website information resources. [Method/Process] This paper elaborates on the connotation and value requirements of government website information resources, analyzes the research progress of knowledge fusion, and based on this, examines the process of knowledge fusion for government website information resources. According to this process, a multi-level knowledge fusion architecture for government website information resources is designed, encompassing "data-level fusion, concept-level fusion, and decision-level fusion," with corresponding operational frameworks constructed for each specific level. [Results/Conclusion] The designed knowledge fusion architecture for government website information resources provides theoretical support and reference for subsequent extensive and in-depth research.

Full Text

Preamble

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Knowledge Fusion System Architecture Design for Government Website Information Resources

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Abstract: [Purpose/Significance]

From the perspective of knowledge fusion, this study addresses the contradiction between the scattered, massive nature of government website information resources and the public's need for integrated, precise knowledge. It aims to provide more effective decision support for users and improve the utilization efficiency of government website information resources.

[Method/Process] This paper elaborates on the connotation and value demands of government website information resources, analyzes research progress in knowledge fusion, and examines the knowledge fusion process for these resources. Based on this analysis, it designs a multi-level knowledge fusion system architecture for government website information resources encompassing "data-level fusion—concept-level fusion—decision-level fusion," with corresponding operational frameworks constructed for each specific layer.

[Result/Conclusion] The designed knowledge fusion system architecture for government website information resources provides theoretical support and reference for subsequent scalable and in-depth research.

Keywords: government website; information resources; knowledge fusion; knowledge map
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According to data from the Chinese government portal, as of December 1, 2017, there were 24,820 operational government websites nationwide, a scale that inevitably generates massive information resources. Taking Beijing as an example, in 2017, municipal governments at all levels proactively disclosed 1.475 million pieces of government information, of which 665,500 were released through government websites, accounting for 37.18% of the total [1]. To further understand the utilization of publicly available information resources on Beijing's government websites, we searched for the hot topic "traffic congestion" and obtained 112,336 results sorted by relevance. The results revealed that information from various levels—including district governance practices, relevant symposiums, and research situations—were intertwined, creating obstacles for users seeking precise information.

Evidently, the explosive growth of government website information resources, while providing richer information to the public, also exhibits constraining characteristics such as high redundancy, strong dispersion, and low correlation. These features weaken the public's ability to select valuable information from massive government websites, creating anxiety over choice difficulties and barriers to reading and screening. The emergence and continuous development of "knowledge fusion" theory offer government departments a new path to address this challenge. Knowledge fusion aims to deeply mine and organize large volumes of dynamic, multi-source, and scattered information resources to achieve knowledge regeneration, appreciation, and innovation. This positioning aligns with the organization and utilization process of government website information resources and can further optimize the knowledge service effectiveness of government websites.

1. Value Demand Analysis of Government Website Information Resources

1.1 Concept of Government Website Information Resources

Government website information resources refer to digital resources released by various government departments on their official portals for the general public. These resources cover economy, education, management, and services, and possess characteristics of openness, timeliness, authority, and perishability [2]. With the rise and maturation of new network and mobile media, an increasing number of government departments have adopted government websites as the forefront for releasing government affairs information.

1.2 Value Demands of Government Website Information Resources

The value of government website information resources reflects subjective perceptions of the degree to which government departmental value demands are satisfied, directly interfacing with the public's information and knowledge needs. Specifically, these demands manifest in three aspects:

(1) **Breadth of resource content.** The breadth of coverage directly affects the scope of public information acquisition. Taking the China Public Information Integration Service Platform as an example, its information resources span 22 themes including fiscal and financial audit information, Hong Kong, Macao, Taiwan and overseas Chinese affairs, national defense, urban-rural construction and environmental protection, science and technology education, ethnic and religious affairs, health and sports, and comprehensive government affairs. Among these, urban-rural construction and environmental protection information has the highest record count at 786,187, while national defense information has the lowest at 18,350. Extensive information resources constitute the basic condition for satisfying citizens' and governments' fundamental information value demands [3].

(2) **Diversified and precise functional demands.** This requires full integration between government websites and mobile terminals and social platforms [4]. As mobile terminal and social media technologies mature, mobile government affairs has become an evaluation metric for government websites. According to a Tsinghua University survey of 415 government portal websites nationwide, 59.2% had established government WeChat accounts in 2017, though 12.8% updated infrequently and 27.2% had not yet established WeChat accounts. Additionally, 28.4% of websites had built apps with good update status, 22.2% had apps with low update frequency, and 49.4% had not yet built apps [5]. Government website ac-

cess to mobile terminals and social platforms ensures functional diversity and precision, representing another value demand for government website information resource construction.

(3) **Comprehensive demand for resource value.** This comprehensive demand manifests in usability, timeliness, relevance, and practicality, directly correlating with public efficiency in accessing government website information resources. Therefore, government departments need to comprehensively associate and integrate service resources to maximize satisfaction of the public's comprehensive value demands.

These value demands determine the characteristics of government website information resources: massive quantity, broad scope, and information complexity. Consequently, employing knowledge fusion methods to form logical relationship-based knowledge products that meet user needs has become urgent.

2. Knowledge Fusion and Its Research Progress

The concept of "knowledge fusion" originates from knowledge engineering, evolving from data fusion to information fusion and finally to knowledge fusion, gaining scholarly attention in the 1990s [6]. Research on knowledge fusion within library and information science is conducted from a knowledge science perspective [7]. Currently, there is no unified definition of knowledge fusion's connotation domestically or internationally. Based on multiple scholars' perspectives, this paper concludes that knowledge fusion at its current stage is a research paradigm concerning information resource organization and integration—a technical tool and 思维模式 that employs semantic web, linked data, and data mining to extract, match, and integrate dynamic, multi-source, and scattered knowledge objects, weakening or eliminating these characteristics to ultimately form a new knowledge layer and achieve knowledge appreciation.

Through literature review, this paper summarizes academic research on knowledge fusion into four layers: big data environment layer, fusion system framework layer, key technology layer, and application practice layer, as shown in [Figure 1: see original paper]. Additionally, this paper reviews research progress on knowledge fusion within the government website domain.

2.1 Joint Exploration of Knowledge Fusion and Big Data Environment

Studying knowledge fusion within the big data environment represents the trend of the era. In recent years, scholars have regarded knowledge fusion as a growth point for knowledge services in the big data era [9], believing that new changes have emerged in knowledge fusion processes under big data environments [10]. These changes have promoted the reconstruction of knowledge fusion frameworks oriented toward big data environments. For instance, Fan Hao applied knowledge fusion process models to big data knowledge service frameworks, effectively combining knowledge fusion, knowledge services, and big data to better satisfy users' personalized and innovative needs while providing theoretical support for related research [11]. Wang Yuefen analyzed key issues of knowledge fusion in the big data era from the perspective of knowledge ecology reconstruction and built a knowledge fusion process and framework for knowledge ecology reconstruction and disciplinary innovation services from a DIKW value chain perspective [12].

2.2 Research on Knowledge Fusion System Framework Construction

Knowledge fusion frameworks and systems provide logical starting points and unified support for research. Regarding framework construction, Fang Xiaoke examined knowledge fusion research from an open-world perspective. To overcome heterogeneity and knowledge expansion limitations in multi-source vocabularies, she demonstrated knowledge fusion paradigms based on Popper's world theory and proposed the "MtFFO" framework for multi-source vocabulary fusion [13]. In terms of knowledge fusion systems, the most representative is the KRAFT (Knowledge Reuse and Fusion Transform) system developed by P.M. Gray's team, which pioneered knowledge fusion system architecture and laid a strong foundation for subsequent system construction [14]. Subsequently, A. Nikolov et al. established the Knofuss system, which combines application problem-solving techniques to select different methods for different domains and tasks [15].

2.3 Analysis of Key Knowledge Fusion Technologies

Key knowledge fusion technologies refer to algorithm research for implementing knowledge fusion, focusing on semantic rules, topic maps, fuzzy set theory, Bayesian networks, and data mining. For example, Gou Jin designed a knowledge fusion algorithm based on ontology and semantic rules, improving the accuracy of fusion results [16]; Lu Huimin extended traditional topic map patterns based on full information theory and designed an extended topic map similarity algorithm for multi-source heterogeneous knowledge fusion [17]; Han Liyan transplanted information fusion processing technology to knowledge fusion, forming a knowledge fusion algorithm based on fuzzy set theory and deriving relevant processing flows and Petri net-based fusion models [18]; E. Santos et al. combined probability models with traditional Bayesian networks, successfully transforming probability models into Bayesian knowledge bases and proposing Bayesian knowledge fusion algorithms [19].

2.4 Discussion on Knowledge Fusion Application Practice

Recent application practice research on knowledge fusion has emerged vigorously across diverse fields, including library and information science, electronics manufacturing, military affairs, and computer science. For instance, Tang Xiaobo applied knowledge fusion to personalized product recommendations, analyzing product features from consumption value perspectives, mining user preferences, and fusing traditional collaborative filtering and knowledge filtering recommendation algorithms using D-S evidence theory to achieve personalized recommendations [20]; A. Smirnov et al. used distributed knowledge network methods to analyze knowledge fusion and multi-agent structures, completing applications in electronics manufacturing [21]; Shen Wang introduced knowledge fusion into digital reference services, extracting, cleaning, and matching knowledge ontology libraries based on domain ontology mapping technology, and constructing a digital reference knowledge fusion framework to enhance service capabilities [22]; Cheng Quan introduced the concept of "knowledge factors" and proposed a collaborative annotation-based knowledge fusion mechanism to promote expert knowledge innovation in network communities [23].

2.5 Research Progress on Government Website Knowledge Fusion

Although research on knowledge fusion for government website information resources possesses rationality and scientific validity, academia has not yet formed a mature system. Scholars often focus on using theories or technologies from specific stages of knowledge fusion to address certain fusion problems for different information resources on government websites. For example, Zhao Hui addressed the "internal siloization" problem of government website information resources by using information architecture theory to design an evaluation index system, aiming to logically organize fragmented and chaotic resources into a clearer, more integrated organizational system—reflecting knowledge acquisition and conversion processes [24]; Ding Nan analyzed government information aggregation from the perspective of linked data technology, which facilitates aggregation of government information resources and benefits scientific decision-making by users and government—reflecting knowledge association processes [25]; Hu Haibo proposed an e-government knowledge service model based on knowledge fusion theory to address government knowledge service issues. As government websites are important components of e-government construction, this model can also apply to knowledge fusion of government website information resources, embodying knowledge acquisition, conversion, fusion, and service processes [26]; Mao Xiumei analyzed knowledge acquisition, analysis, representation, and association technologies in the context of government response to online public opinion, constructing an OGSA-based network public opinion knowledge service architecture that offers reference significance for government website information resource knowledge fusion research [27].

Based on previous research, this paper focuses on the entire process of government website information resource knowledge fusion, designing a multi-dimensional knowledge fusion framework and proposing corresponding implementation methods.

3. Process Analysis of Government Website Information Resource Knowledge Fusion

Understanding and analyzing the knowledge fusion process for government website information resources provides strong guidance for grasping the system architecture. This paper conducts targeted research on key processes based on the inherent characteristics of these resources. The knowledge fusion process comprises four core stages: knowledge acquisition, knowledge conversion, knowledge fusion, and knowledge service [28]. Additionally, from the perspective of knowledge ordering, reorganization, and clustering, the entire process divides knowledge into three distinct stages: generalized knowledge, classified knowledge, and associated/clustered knowledge. The process is illustrated in [Figure 2: see original paper].

3.1 Knowledge Acquisition

Raw data constitutes the basic unit for the entire knowledge fusion process. For massive, scattered, and redundant government website resources, the raw data information contained in web pages exists in dynamic, diverse, complex, and distributed states. Therefore, the first step involves acquiring raw data from web pages in these states. Government website information resources include sections on information disclosure, online services, and public participation, covering specific content such as policies and regulations, institutional profiles, online consultation, public forums, featured introductions, statistical yearbooks, and convenience services. During raw data acquisition, preliminary and rough screening can be performed based on thematic requirements to filter out web data with knowledge characteristics.

3.2 Knowledge Conversion

The knowledge acquisition process has already conducted preliminary screening of raw web data to obtain knowledge-characteristic data. The goal of knowledge conversion is to transform these data into knowledge resources, achieving the knowledge-ization of web resource content [29]. Knowledge conversion methods include knowledge extraction, filtering, decomposition, ordering, and representation. While resources after simple extraction, filtering, and decomposition remain disorganized, subsequent knowledge ordering transforms disorder into order through unified resource content description. Finally, through explicit knowledge resource representation, the initial knowledge-characteristic web data is successfully converted into logical semantic knowledge.

3.3 Knowledge Fusion and Knowledge Service

Knowledge fusion algorithms constitute the key supporting factor for knowledge fusion [30]. Knowledge fusion upgrades logical semantic knowledge into domain knowledge with decision-support functions through algorithms. This process requires applying knowledge fusion algorithms to perform knowledge reorganization, classification, and clustering on knowledge obtained and processed in the previous three stages. Knowledge reorganization performs deep reclassification and merging of knowledge resources. Knowledge association analyzes the hidden, ordered relationships within reorganized knowledge. Finally, knowledge clustering groups thematically similar or related knowledge together, laying a solid foundation for knowledge service. Knowledge service, the final stage, aims to provide fused knowledge to users for decision support.

4. Knowledge Fusion System Architecture for Government Website Information Resources

As described in Section 3, government website information resources form three knowledge stages during fusion: generalized knowledge, classified knowledge, and associated/clustered knowledge. Generalized knowledge emerges during knowledge acquisition and conversion, classified knowledge arises from knowledge reorganization, and associated/clustered knowledge results from knowledge association and clustering. Generalized knowledge is a macro-level concept based on content, representing universal attributes of government website information resources after semantic analysis. Classified knowledge is structure-oriented, referring to structurally streamlined and optimized knowledge after domain ontology concept merging. Associated/clustered knowledge is application-oriented, involving the association and clustering of generalized and classified knowledge to form complete, decision-oriented domain knowledge.

Data-level fusion addresses generalized knowledge, using semantic description and other technologies to construct knowledge networks that macroscopically describe theme-specific resources. Concept-level fusion addresses classified knowledge, using ontology merging and domain concept acquisition to partition knowledge networks into classified organizational structures. Decision-level fusion addresses associated/clustered knowledge, relying on knowledge networks and classified organizational structures to form knowledge maps that provide decision support through knowledge discovery and fusion algorithms.

Drawing on mature knowledge fusion systems such as KRAFT [14], Knofuss [15], and SemFus [31], this paper constructs a three-level architecture from the perspectives of generalized, classified, and associated/clustered knowledge: a data-level fusion layer for generalized knowledge, a concept-level fusion layer for classified knowledge, and a decision-level fusion layer for associated/clustered knowledge [32], as shown in [Figure 3: see original paper].

4.1 Data-Level Fusion for Generalized Knowledge

Data-level fusion for generalized knowledge constitutes the first level of the architecture and the foundation for concept-level and decision-level fusion. Its primary task is to achieve preliminary, simple associative fusion among knowledge resources using RDF linking and data association, ultimately establishing theme-specific knowledge networks for government website information resources [33]. The framework is shown in [Figure 4: see original paper].

The framework includes resource acquisition and preprocessing, ontology modeling, knowledge representation, and knowledge network construction:

(1) **Resource acquisition and preprocessing.** The internet contains massive, unordered information on government website web pages. After acquisition, these resources require thematic classification based on thematic feature values. Using automated deep indexing, page denoising, and web page segmentation, the system extracts thematic information and performs feature analysis on data returned by the acquisition engine, storing analyzed resources in a text database.

(2) **Ontology knowledge base establishment.** Although resources after acquisition and preprocessing possess certain thematic features, they require further ordering. Due to metadata limitations in efficiently and accurately describing these resources, ontology technology is introduced into metadata management to locate, extract, and transform ontology metadata from SQL, XML, and RDF data sources, storing them in RDF format in the ontology knowledge base.

(3) **Knowledge network construction.** Resources in the ontology knowledge base in RDF format are semi-structured. By introducing the concept of "knowledge elements" and combining ontology mapping technology, hidden relationships among massive government website information resources are identified, presenting semi-structured resources in a comprehensible knowledge network form through ontology semantic association methods.

Key technologies for data-level fusion include focused crawling, semantic description, and knowledge element-ontology mapping:

(1) **Focused crawling.** As the foundation of knowledge fusion, focused crawling addresses the thematic distribution of government website information resources. Using machine learning-based adaptive focused crawling, the system studies government website thesauri and employs statistical-based web page thematic information extraction methods via DOM tree structures, page denoising, and Chinese automatic word segmentation.

(2) **Semantic description technology.** This technology achieves formal expression of thematic content—structured semantic function expansion. Building upon government website information resource metadata standards, ontology technology enables richer description to form an ontology-driven metadata model, using the seven-step method to construct domain knowledge ontologies.

(3) **Knowledge element-ontology mapping technology.** This technology achieves unified object-oriented representation of knowledge elements characterized by domain knowledge ontologies. It first addresses knowledge element extraction by preliminarily defining semantic organization frameworks, then maps knowledge elements to corresponding ontologies to establish semantic links.

4.2 Concept-Level Fusion for Classified Knowledge

Concept-level fusion for classified knowledge serves as the intermediate layer, playing a connecting role. Its main task is to associate and fuse domain concepts within knowledge networks, perform finer-grained concept merging, form classified knowledge organization systems, and ultimately eliminate redundancy. The framework is shown in [Figure 5: see original paper].

The framework includes domain concept acquisition, domain ontology concept relationship identification, and domain knowledge ontology merging:

(1) **Domain concept acquisition.** Sources include entity concepts, attribute concepts, and relationship concepts [34]. Domain concepts can be acquired using RDF's concept definition functions, RDF linking, maximum entropy models, and Voronoi graphical methods.

(2) **Domain ontology concept relationship identification.** Domain ontology concepts possess different forms and relationship types including hypernym-hyponym, instance, sequence, and pricing relationships. Using domain concept extraction algorithms combined with rule-based matching methods to identify inter-concept relationships and establish hierarchical structures constitutes an essential step for building classified knowledge organization systems.

(3) **Domain knowledge ontology merging.** After identifying inter-concept relationships, mapping methods construct domain knowledge ontology mapping models for semantic similarity calculation, completing ontology merging to form logical classified knowledge organization systems that reduce redundancy and improve utilization efficiency.

Key technologies include hybrid domain concept acquisition, automatic extraction algorithms, and domain knowledge ontology merging:

(1) **Hybrid domain concept acquisition method.** This combines statistical and rule-based algorithms, improved according to government website information resource characteristics to form an ontology representation-based algorithm. It performs qualitative reasoning via RDF linking, quantitative reasoning via Voronoi diagrams, weight calculation via maximum entropy models, and finally acquires domain concepts under ontology representation.

(2) **Automatic extraction algorithm.** This identifies and extracts domain ontology concept relationships using pattern-matching algorithms for relationship matching and statistical algorithms for statistical measurement calculation, combining both to ensure accurate identification and extraction.

(3) **Domain knowledge ontology merging technology.** Merging reduces redundancy in knowledge networks. The process involves establishing domain ontology concept classification systems, utilizing mapping models

for feature extraction and concept alignment, and focusing on semantic similarity calculation between domain ontology concepts through a framework comprising ontology parsing modules, ontology libraries, and semantic similarity calculation modules.

4.3 Decision-Level Fusion for Associated/Clustered Knowledge

Decision-level fusion for associated/clustered knowledge represents the highest level of the architecture and the ultimate value realization of data-level and concept-level fusion. Its main task is to deeply analyze and process selected domain knowledge with hidden relationships, providing domain knowledge maps with decision-support functions. The framework is shown in [Figure 6: see original paper].

The framework includes:

(1) **Knowledge mining, association analysis, and clustering description application.** This process groups knowledge resources with high similarity and relevance into the same clusters through knowledge mining to discover associated resource groups, association analysis to present interrelationship patterns, and clustering description to aggregate thematically similar government website information resource groups.

(2) **Application of domain knowledge fusion algorithms based on association mining and semantic clustering.** These methods discover temporal, causal, and agglomerative hierarchical relationships among domain knowledge. Temporal association-based fusion produces temporal association graphs according to time series relationships. Causal association-based fusion forms causal association graphs following causal laws. Agglomerative hierarchical clustering-based fusion forms clustering hierarchical trees from a knowledge clustering perspective.

(3) **Knowledge map construction.** This involves extracting knowledge points from associated/clustered domain knowledge, describing them to form knowledge nodes, and comprehensively utilizing temporal association graphs, causal association graphs, and clustering hierarchical trees to complete domain knowledge map construction. Knowledge maps serve as graphical navigation tools for knowledge resource display, providing view-based knowledge acquisition, exchange, and development services for users [35].

Key technologies include knowledge discovery, knowledge fusion algorithms, and visualization and human-computer interaction:

(1) **Knowledge discovery technology.** This implements the association clustering process through text content-oriented and network structure-oriented knowledge mining to discover related resource groups, knowledge association technology to establish association rules for analysis, and clustering operations to form knowledge resource classes.

(2) **Knowledge fusion algorithms.** This paper employs temporal association fusion algorithms, causal association algorithms, and agglomerative hierarchical clustering fusion algorithms to implement associated/clustered knowledge fusion from temporal, causal, and hierarchical perspectives.

(3) **Visualization and human-computer interaction technology.** These intelligent technologies help users enjoy knowledge fusion 成果. For example, establishing knowledge maps or knowledge graphs based on the fusion 脉络 provides users with three-dimensional, interactive, visual decision support for intuitive, rapid knowledge resource acquisition.

References

[1] 2017 Annual Report on Government Information Disclosure Work in Beijing [EB/OL]. [2018-03-27]. http://zhengwu.beijing.gov.cn/zwzt/2017nb/.

[2] Huang Xinping, Wang Ping, Li Zongfu. Research on the Collection and Construction of Native Digital Government Information Resources from Government Websites [J]. Library Work and Research, 2017(6): 87-92.

[3] China Government Public Information Integration Service Platform [EB/OL]. [2018-03-27]. http://govinfo.nlc.gov.cn/.

[4] Luo Xianchun, Xiao Wenfang, Wen Tingxiao. Analysis of Value Demands for Government Information Resources: Taking Government Portal Websites as an Example [J]. University Library Work, 2017, 37(5): 47-51.

[5] Chinese Government Portal [EB/OL]. [2018-03-27]. http://www.gov.cn/.

[6] Liu Xiaojuan, Li Guangjian, Hua Bolin. Knowledge Fusion: Conceptual Analysis and Definition [J]. Library and Information Service, 2016, 60(13): 13-19, 32.

[7] Dang Hongli. Analysis of Current Status of Knowledge Fusion Research in China from the Perspective of Knowledge Science [J]. Journal of Intelligence, 2015, 34(8): 158-162.

[8] Tang Xiaobo, Zhu Juan, Yang Fenghua. Research on Knowledge Fusion Framework Model in Big Data Environment [J]. Library Science Research, 2016(1): 32-35, 18.

[9] Tang Xiaobo, Wei Wei. Knowledge Fusion: The Growth Point of Knowledge Services in the Big Data Era [J]. Library Science Research, 2015(5): 9-14, 8.

[10] Zhang Xinyuan, Qiu Junping. Research on Knowledge Fusion Framework in Big Data Environment [J]. Library Science Research, 2016(8): 66-70, 43.

[11] Zhou Liqin, Fan Hao, Pan Jianpeng. Research on Big Data Knowledge Service Framework Based on Knowledge Fusion Process [J]. Library Science Research, 2017(21): 53-59.

[12] Wang Yuefen, Cen Yonghua. Research on Knowledge Fusion System Architecture Design in the Big Data Era [J]. Digital Library Forum, 2016(10): 16-24.

[13] Yan Chengxi, Fang Xiaoke. Open World Perspective: Research on Knowledge Fusion Framework MtFFO for Multi-Source Vocabularies [J]. Journal of

Library Science in China, 2017, 43(4): 114-129.
[14] PREECE A, HUI K, GRAY A, et al. The KRAFT architecture for knowledge fusion and transformation [J]. Knowledge-based systems, 2000, 13(2): 113-120.
[15] NIKOLOV A, UREN V, MOTTA E. Knofuss: a comprehensive architecture for knowledge fusion [C]//Proceedings of the 4th international conference on knowledge Capture. San Francisco: ACM, 2007: 185-186.
[16] Gou Jin. A Knowledge Fusion Method Based on Semantic Rules [C]//Proceedings of the 2006 National Annual Conference on Theoretical Computer Science. Chongqing: China Computer Federation Technical Committee on Theoretical Computer Science, 2006: 11.
[17] Lu Huimin, Feng Boqin, Li Xu. Extended Topic Map Similarity Algorithm for Multi-Source Knowledge Fusion [J]. Journal of Xi'an Jiaotong University, 2010, 44(2): 20-24.
[18] Zhou Fang, Liu Yuzhan, Han Liyan. Research on Knowledge Fusion Method Based on Fuzzy Set Theory [J]. Journal of Beijing Institute of Technology (Social Sciences Edition), 2013, 15(3): 67-73.
[19] SANTOS E. Fusing multiple bayesian knowledge sources [J]. International journal of approximate reasoning, 2011, 52(7): 935-947.
[20] Zhu Juan, Tang Xiaobo. Personalized Product Recommendation Based on Three-Layer Knowledge Fusion Model [J]. Library Science Research, 2017(5): 24-30.
[21] SMIRNOV A, PASHKIN M, CHILOV N, et al. Ksnet-approach to knowledge fusion distributed sources [J]. Computing and informatics, 2012, 22(2): 105-142.
[22] Shen Wang, Li Yafeng, Hou Haochen. Research on Digital Reference Knowledge Fusion Framework [J]. Library and Information Service, 2013, 57(19): 139-143.
[23] Cheng Quan. Research on Knowledge Fusion Mechanism of Scientific Research Community Based on Collaborative Annotation [J]. Information Theory and Practice, 2011, 34(8): 20-25.
[24] Zhao Hui, Liu Jun. User-Centered Information Architecture and Network Governance—Research on "De-siloization" of Government Website Information Resources from the Perspective of Information Architecture Theory [J]. Public Management Journal, 2013, 10(1): 128-136, 144.
[25] Ding Nan, Wang Yu, Pan Youneng. Research on Government Information Aggregation Based on Linked Data [J]. Information Theory and Practice, 2015, 38(7): 76-79, 85.
[26] Hu Haibo, Gao Peng. E-Government Knowledge Service Model and System Construction Based on Knowledge Fusion [J]. Information Science, 2016, 34(9): 124-128.
[27] Mao Xiumei, Yang Ye. Research on Government-Oriented Network Public Opinion Knowledge Service System Construction [J]. Digital Library Forum, 2017(4): 2-9.
[28] Xu Xukan, Zheng Changxing, Jiang Xun. Construction of Knowledge Organization Model Based on Granularity Principle [J]. Information Studies:

Theory & Application, 2015, 38(7): 76-79, 85.
[29] Zhu Zhenyuan, Li Guangjian. Preliminary Exploration of Knowledge Fusion from the Holistic Perspective of "Data-Information-Knowledge"—The Relationship and Comparison of Data Fusion, Information Fusion, and Knowledge Fusion [J]. Information Studies: Theory & Application, 2017, 40(2): 12-18.
[30] Zhou Fang, Wang Pengbo, Han Liyan. Multi-Source Knowledge Fusion Processing Algorithm [J]. Journal of Beijing University of Aeronautics and Astronautics, 2013, 39(1): 109-114.
[31] NOUGHABI H A, KAHANI M, BEHKAMAL B. SemFus: semantic fusion framework based on JDL [C]//Innovations and advances in computer, information, systems, and engineering. New York: Springer, 2013: 583-594.
[32] Huang Xinping. Research on Multi-Dimensional Semantic Knowledge Fusion of Government Website Information Resources [D]. Changchun: Jilin University, 2017.
[33] Chen Weidong, Wang Ping, Wang Yicheng, et al. Research on Multi-Dimensional Semantic Knowledge Fusion Structure System and Strategy for Government Website Information Resources [J]. Information Studies: Theory & Application, 2017, 40(6): 111-116.
[34] Lu Jiaying, Yuan Qinjian, Huang Qi, et al. Product Domain Ontology Construction Based on Concept Lattice Theory [J]. Information Engineering, 2018, 4(1): 31-41.
[35] Hu Changping, Zhang Jing, Chen Guo. Classification Construction and Application of User-Oriented Knowledge Maps [J]. Library and Information Service, 2013(6): 8-12, 56.

Author Contributions

Zhang Weidong: Proposed the research framework and revised the paper;
Zuo Na: Wrote the paper;
Lu Lu: Collected materials and translated English content.

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