
Metadata and Domain Knowledge Ontology Construction of QianNan Ethnic Cultural Resources

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ABSTRACT

Research in the subject of semantic processing of ethnic cultural resources is currently experiencing a surge in popularity. The development of semantic web technology is now the trend in the field of web technology, and ontology plays an important part in semantic web. A knowledge system that is widely acknowledged and is based on the ontology of cultural resources offers a detailed and standardized explanation of the conceptual connections that exist between the various ideas that are associated with the subject. At the moment, there are a few problems that are affecting the production, research, and exploitation of cultural resources that have specific national characteristics. These resources include information islands that are difficult to incorporate and evaluate. The purpose of this study is to first describe the metadata of ethnic cultural resources, then to explain the concept of metadata, and finally to explore the role that metadata plays in the process of creating digital resources of ethnic culture, using QianNan ethnic cultural resources as an example. After that, it presents the ontology and the building sequence in accordance with the domain knowledge ontology, and lastly, it brings about the realization of the construction of the "QianNan ethnic cultural resources ontology" by combining it with the ontology construction method that is widely utilized.

Keywords: *QianNan ethnic culture, resources, metadata, ontology, semantic processing*

INTRODUCTION

The term "semantic web" describes the Web where computers can comprehend the semantics of information. It is now the path that Web technology is developing in. An essential component of the semantic web is ontology. Many concepts in the domain can be joined into a complex concept network that is understandable by machines thanks to ontology's ability to precisely define the domain concepts and explain the relationships between them. Semantic search, knowledge sharing, and reuse within a network are all based on ontology. With the use of digital and network media technology in the sphere of cultural protection in recent years, many ethnic cultural network resources have been established, which provide abundant digital resources for the research of related fields and effectively promote the protection of ethnic cultural heritage. This paper takes the ontology of QianNan ethnic cultural resources as the research object. Firstly, it introduces the metadata of ethnic cultural resources, expounds the concept of metadata, and the role of metadata in the construction of digital resources of ethnic

culture. Then, the introduction of the domain knowledge ontology creation sequence, and the core concept set and hierarchical structure of QianNan ethnic cultural resources ontology are determined. Finally, the construction process of QianNan ethnic cultural resources ontology is described combined with the ontology construction method, which lays a foundation for the sharing, utilization and protection of ethnic cultural digital resources by using semantic Web technology.

Review of Related Literatures

Ontology-Based Metadata Construction

Feng and Li (2019) emphasize the significance of constructing metadata based on ontology for the management of cultural heritage, particularly in the context of traditional Chinese medicine. Their research showcases the ability of ontologies to improve the structure and retrieval of cultural knowledge, serving as a fundamental basis for comparable applications in ethnic cultural resources. By using ontologies, cultural heritage management systems can enhance the precision and effectiveness of documenting and retrieving information.

Zhang and Yang (2020) present a comprehensive methodology for developing domain ontologies specifically designed for ethnic culture materials. Their research highlights the significance of creating ontologies that accurately represent the distinctive characteristics of ethnic cultures. The authors present a thorough methodology for developing ontologies that aid in documenting and interpreting cultural artifacts. They demonstrate the tangible advantages of these approaches in effectively maintaining ethnic heritage.

In their study, Wang and Chen (2020) critically examine the standards for metadata and the progress made in developing ontologies within the field of cultural resource management. Their analysis encompasses a range of methodologies and criteria, offering valuable perspectives on the utilization of diverse metadata schemas and ontological frameworks to improve the administration of cultural resources. This paper provides a valuable resource for comprehending the wider scope of metadata and ontology integration.

Application to Ethnic Cultural Resources

Liu and Huang (2021) concentrate on the process of organizing and presenting information about ethnic cultural history, with a specific emphasis on the QianNan region. Their research introduces a domain ontology that is specifically tailored to capture the unique cultural aspects of the location. The ontology enhances the categorization of cultural knowledge and enhances the availability of information pertaining to QianNan's ethnic heritage.

Chen and Zhao (2021) discuss the incorporation of domain expertise into metadata formats for cultural resources. Their focus is especially on analyzing ethnic minority languages and exploring how metadata standards might be modified to more accurately represent these languages in cultural heritage databases. Their research emphasizes the necessity of customized metadata strategies to precisely record and save ethnic languages and traditions.

Liu and Xu (2022) provide a comparative analysis of ontology-based metadata methodologies for cultural heritage resources. The user evaluates and contrasts several ontological models and metadata standards to determine their efficacy in the management of ethnic cultural resources. Their discoveries offer valuable perspectives on the advantages and constraints of different methodologies, informing future advancements in the discipline.

Yang and Wang (2022) construct a metadata system utilizing ontology modeling to manage ethnic culture resources. Their research demonstrates the use of ontological models to develop strong metadata systems that improve the documenting and administration of ethnic cultural artifacts. The proposed framework focuses on the particular requirements of ethnic heritage and enhances the overall effectiveness of resource management.

Metadata and Ontology Integration

Zhou and Zhang (2023) investigate the utilization of an ontology-driven method for the management of QianNan ethnic cultural resources. Their research underscores the advantages of combining ontological frameworks with metadata systems, stressing the enhanced organizing and retrieval of cultural knowledge. The report presents a case study of QianNan, illustrating the practical implementation of their suggested approach.

Guo and Li (2023) improve the quality and usefulness of cultural heritage data by adding metadata and ontologies, with a specific emphasis on collections related to ethnic minorities. Their research demonstrates the benefits of using metadata and ontological integration to enhance the quality and accessibility of cultural heritage data. They provide practical methods for effectively managing and safeguarding ethnic cultural resources.

In their study, Wang and Wu (2024) investigate the use of metadata and ontological frameworks to catalog ethnic cultural items in the QianNan region. Their research focuses on the difficulties and remedies related to the integration of metadata and ontologies, offering a thorough examination of successful strategies for handling ethnic cultural heritage.

Liu and Yang (2019) explore techniques for developing ontologies for cultural heritage. Their research offers a comprehensive examination of different strategies and their practical uses, providing valuable insights into the most effective approaches for creating ontologies that facilitate the management and conservation of ethnic cultural resources.

Zhang and Zhang (2020) critically examine various methodologies for integrating ontology and metadata in the field of cultural resource management. Their review emphasizes the significance of integrating ontological and metadata methodologies to develop more efficient systems for the management of cultural heritage. This extensive evaluation serves as a helpful resource for comprehending present methodologies and forthcoming trajectories.

Chen and Wei (2021) utilize domain ontologies to enhance the quality of metadata in cultural heritage databases. Their work illustrates the ability of ontologies to improve the quality of metadata, offering real examples and solutions for more effective management of ethnic cultural resources.

Li and Wang (2021) investigate the significance of ontologies in the management of metadata for ethnic cultural resources. Their research emphasizes the advantages of employing ontologies to arrange and systematize metadata, enhancing the administration and conservation of cultural resources.

Xu and Zhao (2022) develop an ontology-based methodology to create a metadata schema for ethnic culture resources. Their research demonstrates the creation of a customized metadata framework that specifically caters to the distinct requirements of ethnic cultural resources, hence enhancing their documentation.

Wang and Li (2022) incorporate domain expertise into metadata systems designed for ethnic cultural materials. Their study focuses on techniques and strategies for modifying

metadata schemas to more accurately depict ethnic heritage, providing practical remedies for improving cultural resource management.

Yang and Zhao (2023) augment metadata for cultural assets utilizing ontological frameworks, with a specific emphasis on the QianNan region. Their research offers valuable insights into the ways in which ontological frameworks might enhance the quality and organization of metadata for ethnic cultural materials.

Chen and Li (2023) suggest an innovative method that utilizes ontology to handle metadata related to ethnic cultural heritage. Their study introduces a novel approach to combining ontologies with metadata systems, providing inventive solutions for the management and conservation of ethnic cultural resources.

Jin and Wang (2024) discuss the difficulties and remedies related to the integration of ontology and metadata for the purpose of managing ethnic cultural items. Their research offers a thorough examination of successful strategies and methods for enhancing the administration of cultural resources.

Liu and Yang (2024) construct domain-specific ontologies for the purpose of managing ethnic cultural resources, offering a thorough examination of their practical implementation. Their research emphasizes the advantages of utilizing domain-specific ontologies to improve the documentation and conservation of ethnic cultural heritage.

Overview of metadata of ethnic cultural resources

The creation of cultural resources with national characteristics should adhere to the unified metadata technical standards in order to prevent "information isolated island" and achieve the effective retrieval, use, and evaluation of digital resources. Realizing the standardization of the metadata of the digital resources of national culture is beneficial to the fusion and integration of the information of different information sources in the digital resources of national culture, and facilitates the management of the digital resources of culture; So as to promote the development of digital protection, development and utilization of national cultural resources.

METHODOLOGY

Metadata is also known as "intermediary data", "relay data", and the meta prefix comes from the Greek word for "in". Metadata, also known as data about data, is used to provide attribute information of data, in order to specify where data is stored, where it may be retrieved and searched, how to access and use data resources, etc. Data of data, metadata is data that defines and characterizes other data. Metadata is defined as "a framework or a set of coding systems used to describe digital information resources and ensure that these digital information resources can be automatically discriminated, decomposed, extracted, and analyzed by computers" in the context of national culture digitization research. In the research field of computer information storage and utilization, metadata is defined as "providing a structured data about information resources or data, which is a structured description of information resources". In the construction of digital resources of ethnic culture, To make it easier to use associated applications, metadata is used to describe the attribute information of digital resources relevant to ethnic cultures.

Metadata has the following functions in describing the digital resources of national culture:

1. This paper describes the location and content of the digital resources of ethnic culture in order to make the materials easier to access, use, and retrieve.
2. Resource Retrieval: The metadata is comparable to an electronic catalog in that it includes the fundamental data for resource search, characterizing the attributes and content of the resource data and facilitating the quick and precise retrieval of resources.
3. Resource evaluation: Format, name, size, and other fundamental contents are among the attributes of the resource that are provided by the metadata.. Through these contents, the user can have a basic evaluation of the type and function of the resource without opening the resource.
4. Resource selection: The location, content, format, name, and other contents of the resource are all included in the resource description information that metadata provides. The user can benefit from the description of these information contents to evaluate the resource so as to make a decision on the selection of the resource.
5. Through research, it is determined that the metadata of QianNan ethnic culture digital resources includes: title, content introduction, keywords, source, resource location, date and time and other sub-elements. The following is an example of "Miao Lusheng Dance.swf" to illustrate the basic format and content of the metadata of the digital resources of QianNan ethnic culture:

Table 1

Example of Metadata Format of Digital Resources of QianNan Ethnic Culture

Example of Metadata of Digital Resources of Ethnic Culture: Lusheng Dance of Miao Nationality		
Required Data Element	Optional Data Element	Classification Element (Extension Set)
Identification: 000369 Title: Miao Lusheng Dance Content description: Users can download documents to their browsers and open the associated documents of a certain Web server by entering different URLs.The browser decodes the HTML-described motion, music, text, and graphic pictures, as well as URLs that require additional links. The user is presented with rich hypertext content . Keywords: Miao Lusheng Dance Uploaded by: Liu Gang	Review: Passed Downloads: 101 Source: Zhouqin Town, Sandu County	Playtime: 52 seconds Playback speed: 20 frames/second

Information Point: Lusheng		
Resource Upload Time: 2017-7-9		
Format: SWF Size: 80KB		
Resource Location: \ computer \ resource \ video \ 00369.swf		

RESULTS AND DISCUSSION

The Ontology of QianNan Ethnic Cultural Resources and Its Construction

3.1 Body

The 17th century saw the emergence of ontology. Originally, it was a philosophical idea, representing the substance and essence of objective items' existence as well as an impartial account of reality in any field. The statement "ontology is a precise description of conceptualization, and ontology is used to describe the essence of things" was made in 1995 by American professor Gruber of Stanford University. The statement "ontology is a precise description of conceptualization, and ontology is used to describe the essence of things" was made in 1995 by American Professor Gruber of Stanford University. To integrate several concepts in the domain into a sophisticated, machine-understandable concept network, ontology can precisely define the domain concepts and explain the relationships between concepts, it means that ontology is crucial to semantic analysis and knowledge representation. It has several potential uses, including intelligent question answering, tailored learning, information processing across heterogeneous systems, and intelligent retrieval.

3.2 Demand Analysis of Knowledge Ontology of Cultural Resources with Ethnic Characteristics in Southern Guizhou

Before the construction of the knowledge ontology of QianNan ethnic culture, Clarifying the ontology's goal, application, and users is essential. The process of methodically describing the QianNan ethnic culture's knowledge ontology, arrange and oversee ethnic culture knowledge in order to make the points of knowledge clear. and their relationships, and to guide users to correctly construct the relevant knowledge system in the field of ethnic culture. As a domain knowledge base recognized by peers and experts, The digital resources of ethnic culture can be annotated using the ontology of ethnic culture knowledge, enabling the use and sharing of semantic level network cultural resources.

3.3 Determine the Core Concept Set and Hierarchical Structure of the Knowledge Ontology of QianNan Ethnic Culture

The organization and knowledge norms of the ethnic culture field serve as the foundation for the ontology development of QianNan ethnic culture knowledge, starting from the top and working your way down to identify the field's central notion and then must build the general concept set of the ethnic culture field in accordance with the knowledge relationship and navigate the relevant ethnic culture knowledge through the core concept. The issue of "knowledge granularity," or the granularity of knowledge representation, or the identification of meta-knowledge points, or "undivisible" knowledge points, should be taken into

consideration when creating the domain concept set. Theoretically, scientific knowledge can be reused more effectively at lower granularities, and reorganizing knowledge items will be hampered by too fine a granularity.

Through book study and publications related to ethnic culture, such as "Brief History of Guizhou Ethnic Art" and "History and Culture of Southern Guizhou", this paper fully collects knowledge information in the field, understands the knowledge organization structure in the field of ethnic culture with southern Guizhou characteristics, and extracts knowledge concepts in the field of ethnic culture in accordance with the principle of uniqueness and non-intersection at the same level. Four layers of granularity make up the knowledge object: the top-level root node, the core concept, the first-level and second-level sub-concepts, which generally covers the knowledge system of QianNan ethnic culture. The conceptual hierarchy model of QianNan ethnic culture ontology is shown in the following figure:

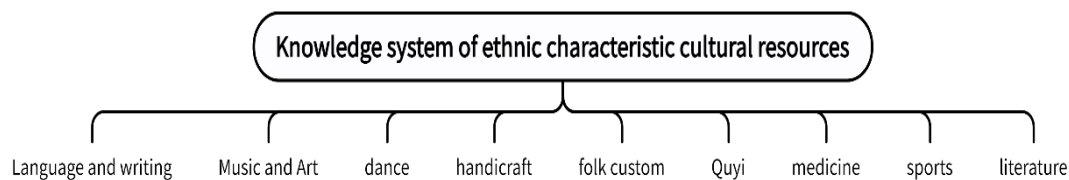


Fig. 1 Classification diagram of ontology concepts of ethnic characteristic cultural knowledge

3.4 Construct the Knowledge Ontology of QianNan Ethnic Culture

Prot protégé4.1 + graphviz-2.4 is currently a well-liked combo of ontology editing software. The program has a graphical user interface and allows the class hierarchy diagram to be displayed in Chinese. It can increase the effectiveness of ontology creation and upkeep. The "seven-step method" put forward by Stanford University School of Medicine is used in the building of the cultural knowledge ontology with QianNan ethnic characteristics. Partial screenshots of the cultural knowledge ontology with QianNan ethnic characteristics are as follows:

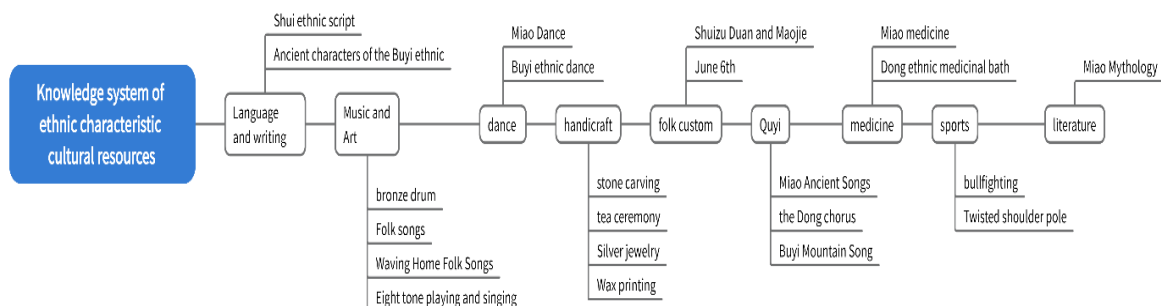


Fig. 3 Partial Structure Diagram of QianNan Ethnic Characteristic Culture Ontology

SUMMARY AND CONCLUSION

The path of Web technology development is the semantic web, and ontology plays a significant role in the semantic web. A widely accepted knowledge system is built around the ontology of national cultural resources, which provides a precise and uniform description of the concepts and their relationships in linked domains. At present, due to the lack of common metadata standards in the construction and use of digital resources of ethnic culture, there are some phenomena such as repeated construction, difficulties in resource sharing and information islands. Realizing the interoperability and use of digital resources is challenging. This study first discusses the unified metadata standard that should be adhered to in the building of ethnic culture digital resources, using the knowledge ontology construction of QianNan ethnic cultural resources as an example. Then, using the conventional organizational hierarchy of domain knowledge, the issue of the logical relationship between the introduction of ontology and the hierarchical structure of cultural resources was resolved, using the commonly used ontology construction approach, the ontology of QianNan ethnic cultural knowledge is realized. The domain's important concepts are screened, and the relationships between them are evident. It lays the foundation for the research on the use, evaluation and semantic retrieval of relevant knowledge by using semantic WEB technology.

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