2010 International Conference on Intelligent Computation Technology and Automation

Study on Ontology-based Knowledge Base Model for Nutritional Evaluation

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***Abstract*—In recent years, ontology as a method of knowledge description has been widely used in knowledge engineering, information retrieval and acquisition, knowledge base system and other information sciences. This article introduced ontology into the fields of nutrition, expounded the basic concepts of ontology and knowledge base, and proposed ontology-based knowledge base model for nutritional evaluation. On this basis, it pointed out that the ontology knowledge base system was important. Finally, it proposed the further research work.**

Keywords-Ontology; Knowledge base; Nutritional evaluation

I. INTRODUCTION

All nutritional evaluation system is based on the nutritional expertise of all aspects of human nutrition in the evaluation of information systems to guide a reasonable diet. With the development of networks and information technology, the system has also shown two new problems:

- Due to the general population and a variety of patient's nutrition assessment system there are certain differences, the knowledge engineers in the process of building a knowledge base, the need to have a good knowledge of domain knowledge.
- The lack of a unified structure of knowledge representation. Combination of expert knowledge to design a reasonable representation of the structure of knowledge-sharing for the system becomes very important.

In recent years, originated in the philosophy of Ontology in information science and knowledge systems have a very wide range of applications. In short, the ontology is to provide a problem for a unified field of knowledge representation, and on this basis, to build a unified formal model of the area, in order to achieve knowledge sharing and reuse between systems.

Currently, ontology applied research in the area of nutrition, and rare. This article will introduce the concept of ontology knowledge of nutritional assessment described in nutritional evaluation system to build the knowledge base model with efficient retrieval, query function and enhance the knowledge base of intelligent reasoning abilities.

II. ONTOLOGY AND KNOWLEDGE BASE

A. Ontology

Ontology originated in philosophy, is to anywhere in the world in the field of real objective description made, and this description may not be entirely based on the existing knowledge base, but also include "seeking" process [1].In the past 20 years, ontology has been widely used in artificial intelligence, knowledge engineering, computer science, knowledge sharing and reuse of important ways. In different disciplines, have different definitions of ontology. In the field of computer science, Stanford University Knowledge Systems Laboratory (KSL) of T. Gruber in 1993 proposed the generally accepted definition, that is "An ontology is an explicit specification of a conceptualization" [2].

On this basis, Studer proposed the concept of ontology consists of four main areas: Conceptualization, Explicit, Formal, Share. Among them, "Conceptualization" refers to the objective world phenomena related to the expression of the concept of an abstract model; " Explicit " refers to the concept and its constraints and relationships between concepts should have a clear definition; " Formal " refers to the precise mathematical expression of so that your computer can handle; " Share " refers to the ontological knowledge is reflected in the user agreement recognized [3].

Therefore, ontology can be formally defined as a two-tuples [4]: $O<C, R>$. In it, C indicates that the set of concepts, R indicates the concept of a collection between the relationships. If the concept C_1 to the concept C_2 has a relationship, is signed by $C_1 \rightarrow C_2(r)$, where C_1 is the source concept of r.C_2 is the target concept of r. If the relationship is signed by the function f that may be expressed as $f(C_1, C_2)$.

B. Knowledge Base

Knowledge is about the definition of a field, facts and rules, knowledge clusters, easy operation and organization. Knowledge base includes knowledge of the facts, rules, knowledge and strategic knowledge. These include areas of knowledge related to theoretical knowledge, factual data, obtained by the expertise heuristic knowledge, such as in an area related definitions, theorems and algorithms, as well as common sense knowledge. Store of knowledge from the point of view, to describe the type approach to store and manage knowledge-based institution is called the knowledge base. From the use of the knowledge point of view, knowledge is knowledge and knowledge processing agencies. Knowledge base system includes the acquisition of knowledge use and management of three areas. Knowledge acquisition is to obtain new knowledge and information and make it systematic. Knowledge acquisition, is also machine learning, knowledge and use of that reasoning. Knowledge base, inference engine and knowledge base system memory is composed of three elements [5].

978-0-7695-4077-1/10 $26.00 © 2010 IEEE
DOI 10.1109/ICICTA.2010.539

C. Application of Ontology Knowledge Base

In practical knowledge representation, the traditional knowledge representation has congenital defects in knowledge representation, transferring, sharing. On the one hand, the expression of the knowledge that it cannot guarantee the transmission and sharing of knowledge and understanding of the process of the uniqueness and unambiguous; the other hand, a large number of atomic knowledge of the environment on the expression of the complex of knowledge and reasoning may have combinatorial explosion. Therefore, the degree of conflict resolution capabilities and knowledge of atomic size, the number and organization of this knowledge directly determines the level of representation available [6]. In order to solve these problems, in the knowledge base introduced the concept of ontology.

In the knowledge base, the ontology knowledge base is used to organize a higher level of knowledge abstraction can also be used to describe the specific areas of knowledge. Therefore, the ontology of the knowledge base provides a standardized meta-model. The introduction of the ontology knowledge base, knowledge representation with the concept, not only can knowledge is the vertical type of the genus, but also through knowledge of the intrinsic linkages between the organization and association, inference machine and then use that knowledge to reason, to improve the knowledge base sharing and reuse. Ontology on the role of the knowledge base has the following points:

- Standardizing terminology. Ontology can play a regulatory role, providing a shared standard terminology, and in a precise manner the semantics of the definition of the term.
- Structural organization of knowledge. Ontology as a semantic and knowledge-level descriptions of the tool, can provide the relationship between the terms defined, so that effective organization of knowledge base, forming an efficient use of system.
- Knowledge sharing and reuse. Ontology of domain knowledge is formalized description provides a standard knowledge representation, is conducive to the sharing and reuse.
- Knowledge acquisition and reliable. Construct the Knowledge Base, on the basis of the original ontology to guide knowledge acquisition, can achieve efficient and reliable access.

III. CONSTRUCTION OF NUTRITIONAL EVALUATION OF THE KNOWLEDGE BASE

A. Knowledge Acquisition

Knowledge acquisition is the first step in building a knowledge base. The method of obtaining the nutritional evaluation knowledge base is mainly manifested in the following areas:

- From the national and industry standards extract restrictive knowledge.
- From the end users data extract resources, knowledge.
- From nutritionist acquire rules and empirical knowledge.
- From historical nutritional data acquire instances.

Through this acquisition process, it will be expressed in explicit domain knowledge used to build the knowledge base.

B. System Model

Nutritional evaluation system with hierarchical structure includes human-computer interaction layer, business logic and data layer. Among them, human-computer interaction layer is the end-users and maintain user interface to interact with the system. WEB way end-users to access; maintain user can directly through a secure manner to maintain the whole system. Business logic layer provide to achieve the end-user query and retrieval of knowledge to the maintenance of the user to provide a reliable operational support. Data layer is the core of the whole system, is an instance of ontological knowledge base, providing the upper data sources.

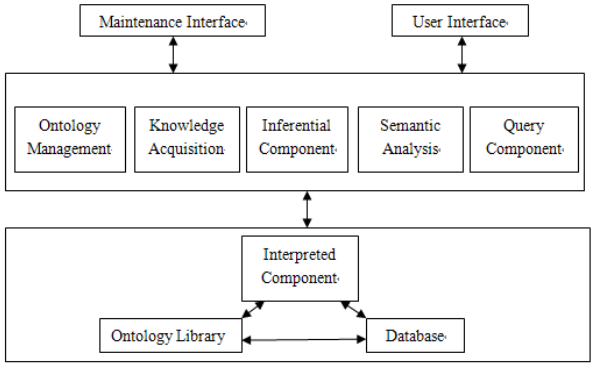

Figure 1. System model

C. Ontology Construction

The purpose of ontology is to provide a unified field of knowledge, the significance of that area to determine the basic terms and relationships, and is given different levels of their formal definition. Generally speaking, ontology is a concept, relationship, functions, axioms and examples of the composition of the five-tuples, so we can build the system model ontology.

Definition: *Nutritional evaluation _Ontology*=$\{C,R,F,A,I\}$ $C=\{c_1,c_2,...,c_n\}$,it means the conceptual set ,any transaction, such as the task, function, behavior, strategies and reasoning, also known as category; $R=\{r_1,r_2,..,r_n\}$, it is relation set and indicates that the relation between the collection refers to the link between concepts, in the nutritional evaluation system it is the relation between the main inheritance, associations, properties, and polymerization; $F=\{f_1,f_2,..,f_n\}$,it is special relation set. In this relation, the former n-1 elements can be the sole decision of the former n elements, $I=\{i_1,i_2,..,i_n\}$,it is instance set, $A=\{a_1,a_2,...,a_n\}$.it is axiom set, means eternal true proposition.

Nutritional evaluation system mainly includes human nutritional status, diet nutrition, nutrition therapy, nutrition

consultation with the four modules. Each module is a knowledge base in the entity. In response to this module, build the corresponding ontology can improve the efficiency of the system.

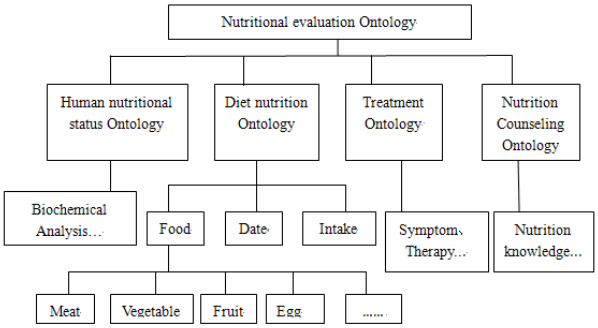

Figure 2. Nutritional evaluation ontology model

- Human nutritional status ontology: The concept of human nutritional status of the body set contains anthropometric assessment, body signs, examination and biochemical tests three aspects; attribute set covers all types of measurement and inspection results of the commentary, such as normal, high or low, and the various indicators and data, etc; relations set includes inheritance, part and whole, correlation and so on.
- Diet nutrition status ontology: Ontological concept of the nutritional status of food set includes body from the food, date and enters the amount of three aspects; attribute set respectively, the quality characteristics of food, nutritional health value; date of the length; input the size of the property; relation set is the same as above mentioned.
- Treatment Ontology: Nutrition therapy, including the treatment of malnutrition and disease are two aspects of nutrition therapy, therefore, the concept of treating body set includes various types of nutritional deficiency symptoms and the clinical symptoms of the disease and the corresponding treatment. Attribute set includes all kinds of symptoms, etiology, disease sexual, signs, illness, course of disease symptoms such as property, but also include the relationship between the properties of various types of treatment methods; relation set is the same as above mentioned.
- Nutrition Counseling Ontology: Nutrition counseling body mainly by the body to prevent malnutrition, body composition and nutritional knowledge. Thus, the concept of malnutrition prevention of body set includes various types of symptoms and prevention of malnutrition; attribute set including the relationship between the properties of various types of prevention methods; relation set mentioned above. Nutrition knowledge of the concept ontology set includes the basic concepts of nutrition; attribute set includes the essential characteristic of a variety of basic concepts; relation set is the same as above mentioned.

D. Implementation Of Ontology Knowledge Base

In the ontology building based on the use of OWL ontology language pairs that achieve the formal knowledge base. Ontology-based retrieval, is essentially describing the semantics of the information query, can greatly improve the efficiency of the knowledge base.

IV. CONCLUSIONS

Ontology technology as described in new ways of knowledge has become a knowledge-engineering and other fields of research focus. It provides a description of formal specifications of domain knowledge to improve knowledge reuse and sharing. Therefore, the ontology knowledge base in expert systems, intelligent decision support systems and other fields are very broad application prospects.

Ontology-based knowledge base for nutritional evaluation, the system describes the abstract structure of the field to establish the link between the concept and the establishment of ontology knowledge-based systems to achieve an efficient reasoning, knowledge sharing and retrieval capabilities to improve the knowledge base level of intelligence. With the development of nutrition for the body of the evolution, expansion and improvement will be the focus of the next work.

REFERENCES

[1] Shanping Li, Qi Yin,Yujie Hu etc Overview of Researches on Ontology[J].Journal of Computer Research And Development,2004,41(7):1042. (in Chinese)

[2] Gruber T R . A translation approach to portable ontology specifications [J] .Knowledge Acquisition, 1993, 5(2):199-220

[3] Rudi Studer, V Richard Benjamins, Dieter Fensel. Knowledge Engineering: Principles and Methods [J].IEEE Transactions on Data and Knowledge Engineering, 1998(25):161-197

[4] Chuxiu Shi. Knowledge Representation Based on Ontology [J]. Journal of Shanxi Normal University, Natural Science Edition, 2007, 21 (2):47-48.(in Chinese)

[5] Bing Liu, Lihong She,Tao Li. Principle of Knowledge Base System [J]. Software Guide 2009, 8(9):149.(in Chinese)

[6] Lei Yuan,Hao Zhang,Jing Chen,Jianfeng Lu Design Pattern of Knowledge Base Based on Ontology Knowledge Model [J] Computer Engineering and Applications.2006.30:65-66.(in Chinese)