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A New Visualization-oriented Knowledge Service Platform

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Abstract

With the rapid growth of knowledge resources and increasing individual demands of users, the problem of how to spend less effort finding knowledge they need has been becoming more and more important. The visualization-oriented knowledge service platform is presented, which includes knowledge acquisition, knowledge categories, knowledge processing, knowledge storage and knowledge visualization. The platform aims to further transfer insights, experiences, attitudes, values, expectations, perspectives, opinions, and predictions by using various complementary visualizations. That is, by using knowledge mapping techniques a large and complex set of knowledge resources can be assimilated and navigated more easily. A prototype system of visual knowledge service has been implemented and applied to the massive knowledge organization, management and service for education.

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Keywords: knowledge service; knowledge visualization; visual navigation

1. Introduction

Knowledge becomes one of critical factors for the development of economy and society gradually in knowledge-based economy and society. Knowledge services [1] are the knowledge-intensive services based on the main resource of knowledge, providing all kinds of knowledge to different organization and persons in order to meet their demands of knowledge, which greatly promote the flow and innovation of knowledge with in the whole society. Therefore, a set of technologies have been developed with the aim of knowledge services. However, the current theoretical researches of knowledge services are not yet

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perfect, more systematic theories researches need to be improved. Foreign researches have focused on the studies at the industry level and researches on the relationship between the knowledge intensive business services and national or regional innovation [2-4]. For example, NKS (the National Knowledge Service) [2] platform is to procure, organise and promote the use of knowledge to improve health and healthcare, it will be organised in four work streams: the Best Current Knowledge Service, the National Library for Health, the National Knowledge Management Network and the National Clinical Decision Support Service. Domestic researches on knowledge services start from library information services in the field of library and information services [5-7]. The most researches until current period still focus on this specific field.

In this paper, based on the comprehensive review of foreign and domestic research documents, according to the insufficiency of those researches, and facing the practice and development of knowledge services, the visualization-oriented knowledge service platform is constructed. The concept of platform of knowledge services based on visualization and a functional framework are given, and the concept, function and key technique of each module in the framework are described and analyzed in detail.

2. Structure

Considering the process of knowledge transfer, the visualization-oriented knowledge service platform can be divided into the following processing module: knowledge acquisition, knowledge categories, knowledge processing, knowledge storage and knowledge visualization. It is shown as Fig 1.

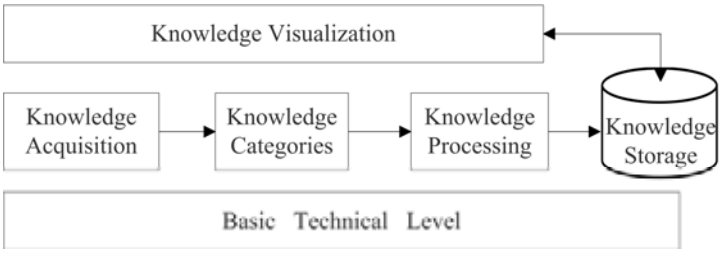

Fig. 1. a visualization-oriented knowledge service platform

At first, knowledge mining is performed to obtain the knowledge elements and the relationships between knowledge elements. Second, knowledge categories provide personalized knowledge services to users, according to the different user groups. Then, knowledge processing can be realized the link or combination between knowledge elements and knowledge units. The processed knowledge will be stored in knowledge mapping in the form of knowledge nodes. At last, knowledge will be display based on visualization.

3. Key technique of each module

3.1. Knowledge acquisition

Knowledge sources generally include three kinds [8]: existing data of investigation and research, obtained information through collection, collation or analysis and expert experience. Different sources, platforms and forms of knowledge need to link and process by unify the standard platform. Knowledge acquisition module also needs to use advanced mining technology (such as Data Mining, Knowledge

Discovery, Machine Learning) to find the new knowledge from much information. The tacit knowledge is obtained through analysis, extraction, restructuring, integration and other means, and the collection of information and knowledge is processed by using a unified platform.

3.2. Knowledge categories

Knowledge services are user-driven to provide users with specialized, pertinent service, so knowledge should be classified according to the different user groups. The user groups can be divided into corporate, government, schools, research institutions and the general user. Users often need specialized, in-depth knowledge that can help decision-making and problem-solving. The knowledge is further classified for different user groups. For example, it can be classified according to subject knowledge for schools and can be classified by industry or f regional Industry features or enterprises.

3.3. Knowledge processing

Knowledge processing performs knowledge extraction to obtain the knowledge elements and the relationships between knowledge elements. A knowledge element is the smallest unit of comprehensive knowledge (such as Data, formulas, facts, conclusions), which in itself is knowledge and can express the complete logic concept. Knowledge elements allow users to access to more detailed knowledge information and provide knowledge elements navigation. Knowledge processing is divided into four stages: semantic paragraph partition, knowledge element classification, anonymous association obtaining, and association recognition [9]. Numbers of knowledge element constitute the knowledge unit, for example an article, a report. Knowledge processing can be realized the link or combination between knowledge elements and knowledge units by information integration or Semantic interconnection.

3.4. Knowledge storage

This module is to build a knowledge base and to store processed knowledge in knowledge mapping in the form of knowledge nodes. Valuable knowledge is often not used because people do not know it exists, even if they know the knowledge exists, they may not know where [10]. These issues lead to the knowledge mapping. Knowledge mapping is navigation to explicit information and tacit knowledge, showing the importance and the relations between knowledge stores and dynamics. The key reasons for doing the knowledge mapping are followings: to find key sources of knowledge creation, to find critical information quickly, to improve decision-making and problem-solving by providing applicable information, and so on. The raw data, which are acquired from one or more sources, are manipulated through basic analysis, to produce first-order data that are suitable for generating knowledge maps. The first-order data are then stored in a central database, which is often referred to as the knowledge-mapping database.

3.5. Knowledge visualization

Knowledge visualization [11] focuses on transferring insights and creating new knowledge in groups. Beyond the mere transfer of facts, knowledge visualization aims to further transfer insights, experiences, attitudes, values, expectations, perspectives, opinions, and predictions by using various complementary visualizations. In this paper, knowledge visualization mainly includes knowledge visual representation, visual navigation, visual recommendation and visual retrieval. The structure is shown as Fig 2.

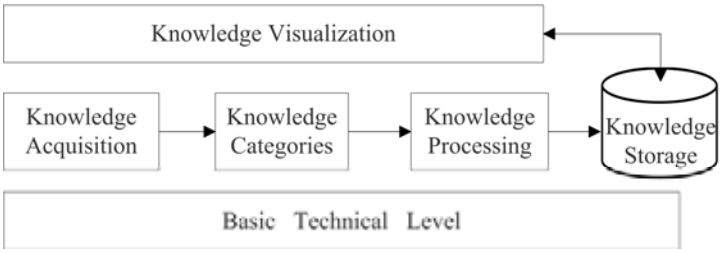

Fig. 2. the structure of knowledge visualization

Knowledge visual recommendation. The knowledge elements and the relationships between knowledge elements are recommended for user by using knowledge recommendation, within a certain knowledge radius and the interesting node of users as the center. The interesting nodes of users are ordered based on trend degree of interesting, which is defined as the following expression:

$$T_{S^i}(i) = Trend_{access}(i) + Trend_{km}(i) \quad (1)$$

$T_{S^i}(i)$ is trend degree of interesting.

$Trend_{access}(i)$ is interesting trend degree based on access logs.

$Trend_{km}(i)$ is interesting trend degree based on knowledge mapping.

Knowledge visual navigation. Knowledge navigation extracts the most probable path as a new user's guide and this path could be learned from old user's a large number of interest paths. There are certain similarities in the cognitive processes of specific areas for users. Such cognitive processes can be expressed as the sequence of knowledge elements [12].

$$\{K_1, K_2, ..., K_u, ..., K_q \mid K_u = K_j, if(K_j \mid \max\{P_u(K_j)\}), 1 \le j \le q\} \quad (2)$$

$P_u(K_i)$ represents the probability of every knowledge element node appears in the navigation path at the u place.

Knowledge visual retrieval. Knowledge visual Retrieval is divided into two parts: one part is the position of searching knowledge element in knowledge mapping, the other is the list of resources including the knowledge element. The resources are ordered, according to the semantic similarity between query conditions. Users can select knowledge elements associated with the current knowledge element and their corresponding the knowledge resources through knowledge mapping.

4. Demonstration

We built the corpus of Computer Network, which knowledge service is shown as Fig 3.

The bold node is regarded as interesting node. Each edge is regarded as a relationship. When user clicking the edge, it will display the relationship type. When clicking the nodes, it will display the resources, which are associated with the knowledge point. The bold lines in the knowledge map represent cognitive path tendency, the numbers on the bold line indicate the sequence of cognitive steps.

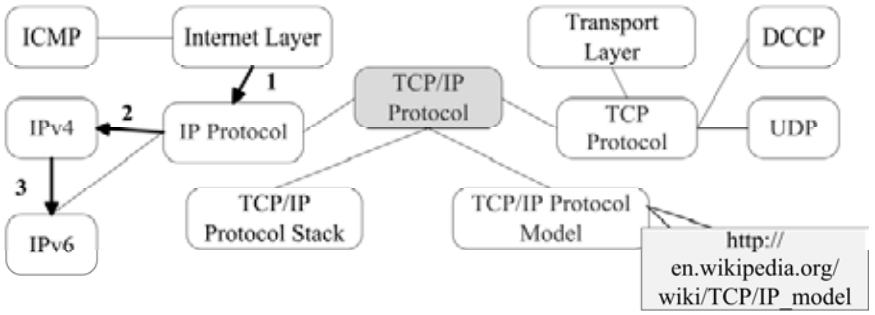

Fig. 3. knowledge service results based on knowledge mapping

5. Conclusions

People can only appreciate what they can actually find, but the most knowledge service systems are not fit to the demands of users, resulting in the feedback of a great deal of useless information. Knowledge must be structured with both user and content in mind so people can successfully find what they are looking for as quickly and easily as possible. Visualization-oriented knowledge service platform focuses on designing effective navigation, organization, labelling, and search systems for websites and creating usable navigation. We are aware that there are likely to be some hidden complications regarding this approach, but we also believe that, the standards could be made from our initiative framework and the real system will be widely deployed in the future.

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