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Investigating effectiveness and user acceptance of semantic social tagging for knowledge sharing

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ABSTRACT

Social tagging systems enable users to assign arbitrary tags to various digital resources. However, they face vague-meaning problems when users retrieve or present resources with the keyword-based tags. In order to solve these problems, this study takes advantage of Semantic Web technology and the topological characteristics of knowledge maps to develop a system that comprises a semantic tagging mechanism and triple-pattern and visual searching mechanisms. A field experiment was conducted to evaluate the effectiveness and user acceptance of these mechanisms in a knowledge sharing context. The results show that the semantic social tagging system is more effective than a keyword-based system. The visualized knowledge map helps users capture an overview of the knowledge domain, reduce cognitive effort for the search, and obtain more enjoyment. Traditional keyword tagging with a keyword search still has the advantage of ease of use and the users had higher intention to use it. This study also proposes directions for future development of semantic social tagging systems.

1. Introduction

Various online activities are becoming an increasingly important part of our life. In recent years, Web 2.0 has led to the development of large Web-based communities that support and facilitate collaboration among Internet users. One class of such systems, collaborative tagging systems also known as social tagging systems, has been prevalent in Web 2.0. Popular collaborative tagging services include Delicious (social bookmarking), Flickr (photo sharing), and CiteULike (academic paper sharing).

A collaborative tagging system is a user-centric, social and democratic indexing system. Users are allowed to create their own tags and associate these tags with digital resources such as articles, photos, or websites shared on the system. Additionally, users can search for the resources that other users have tagged using personal vocabularies. A resource can be tagged with an unlimited number of tags. Therefore, users do not need to comply with a complex classification system and only enter the keywords that first come into mind. Novices are able to immediately participate in the system because it simply shifts from professional categorization to social tagging (Kroski, 2005). The aforementioned advantages make collaborative tagging systems one of the most popular Web 2.0 systems.

However, existing collaborative tagging systems suffer from the vague-meaning problem when users retrieve or present resources with keyword-based tags. The vague-meaning problem is created by the following causes (Hope, Wang, & Barkataki, 2007; Kroski, 2005; Marchetti, Tesconi, Ronzano, Rosella, & Minutoli, 2007):

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1. Synonyms, polysemys, and homonyms: Existing collaborative tagging does not allow for formal identification of synonyms, which leads to the fracturing of collections. For example, "blog" and "Web log" have the same meaning but collaborative tagging systems do not understand it. Moreover, existing collaborative tagging systems are not able to distinguish between polysemys or between homonyms. For example, the tag "flash" may represent the multimedia player, the lighting device of a camera, or the compact flash memory.
2. Term variations: There is no standard for the structure of tags; for instance, a noun can be singular or plural, uppercase or lowercase. Moreover, mis-tagging due to spelling errors occurs often. Spacing is not allowed in a tag in most collaborative tagging systems, and therefore both the underscore and the hyphen are typically used to separate words by a single tag. Additionally, different possible spellings of the same word and tags using different languages generate term variations.
3. Personalized tags: Unorthodox or personalized tags that convey no meaning by natural language and only make sense to an individual user.
4. Lack of relationships: Relationships between tags cannot be structured in existing collaborative tagging systems. Resources might be labeled with the tags "coffee" or "cappuccino," and there is no mechanism that might indicate that cappuccino is a sub-class of coffee. The lack of hierarchy causes systems to be unable to deal with different specificities or basic levels of the words chosen to tag a resource. In addition to hierarchical relationships, other relationships should be structured between tags to improve content searches. For example, "coffee shop," "café," and "convenience store" have a "sell" relationship with "coffee," so that all resources about coffee sellers can be easily retrieved.

Keyword-based tagging systems are not able to understand the meaning of tags and the relationships between tags. Consequently, content searches fail to locate content identified by different tags with the same meaning and fail to distinguish irrelevant content identified by the same tag but with a different meaning, which reduces search recall and precision. The performance of information retrieval supported by social tagging is lower than that of search engines and the methods by which folksonomies can increase the effectiveness of their internal searching functions deserve further study (Morrison, 2008).

Some studies have demonstrated how to develop semantic tagging systems that considered tag meanings (Chen & Roberts, 2007; Hope et al., 2007; Jiao & Chen, 2010; Marchetti et al., 2007), however, they did not rigorously examine system effectiveness and user acceptance. This study develops a semantic tagging system for supporting knowledge sharing. Knowledge management systems are applied to leverage organizational knowledge through knowledge creation, knowledge storage/retrieval, knowledge transfer, and knowledge application (Alavi & Leidner, 2001). These systems are not as successful as anticipated because the existing systems are limited to serve as content repositories and neglect the tasks that organize and extract the maximum possible value of the contributions. Knowledge storage and retrieval are the most important activities for the manipulation of explicit knowledge. The most common problem in knowledge retrieval is that much of the retrieved content is irrelevant to users' demands. The possible ways to improve searching functions for knowledge management systems are increasing users' knowledge of the context of their information requirements, and improving their knowledge of the domain being searched. Knowledge maps and visualization techniques can be used to improve organization, maintenance, and the extraction of valuable content from knowledge management systems. Visualization techniques can be applied to help users understand available information more easily. A knowledge map employs visualization techniques to provide a unified environment for finding relevant information, which allows content to be put in a context. Accordingly, this study expects that introducing semantic tagging with visualized knowledge map is able to improve the quality of knowledge retrieval. Based on the current problems of collaborative tagging systems and knowledge retrieval, the research objectives are:

1. *Designing a semantic social tagging system to tackle the problems of keyword-based tagging*: The proposed semantic social tagging system provides tags from the ontology when users tag contents. The ontology is a file expressing concepts, individuals, and their relationships in a given domain. Users can collaboratively maintain the ontology via an ontology editor. The tags must be words that represent concepts or relationships in the ontology; thus the system is able to understand the meanings of tags and avoid the unclear-meaning problem. The performance of keyword and semantic tagging mechanisms will be evaluated by measuring users' tagging behavior, and perceived usefulness, perceived ease of use, perceived enjoyment, and intention to use, based on the Technology Acceptance Model (Davis, 1989; Venkatesh & Bala, 2008).
2. *Designing semantic searching mechanisms that take advantage of semantic social tags*: The semantic searching mechanisms comprise triple-pattern search and visual search modules. The triple-pattern search module enables users to search for related content by specifying subjects, predicates, and objects. The visual search module helps users search for content by clicking concept nodes or relationship links in the visualized knowledge map. These semantic searching mechanisms help the user to understand the meanings of semantic tags and to return all the resources that their semantic tags match to user-specified concepts, individuals, or relationships. The performance of searching mechanisms will be evaluated by their precisions, recall, and users' perceptions.

2. Literature review

This section firstly introduces knowledge management and the knowledge map. Then, the features of collaborative tagging are mentioned. Finally, Semantic Web technology is briefly described.