



# A recommender mechanism for social knowledge navigation in an online encyclopedia



Yung-Ming Li\*, Lien-Fa Lin, Yu-Hui Lin

*Institute of Information Management, National Chiao Tung University, Hsinchu 300, Taiwan*

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## ABSTRACT

In today's world, knowledge is important for constructing core competitive advantages for individuals and organizations. Recently, Web 2.0 applications and social media have provided a convenient medium for people to share knowledge over the Internet. However, the huge amount of created knowledge can also leads to the problem of information overload. This research proposes a social knowledge navigation mechanism that utilizes the techniques of relevant knowledge network construction, knowledge importance analysis, and knowledge concept ontology construction to generate a visualized recommendation of a knowledge map of sub-concept and knowledge of an article reading sequence for supporting learning activities related to a free online encyclopedia. The results of experiments conducted on Wikipedia show that the proposed mechanism can effectively recommend useful articles and improve a knowledge seeker's learning effectiveness.

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## 1. Introduction

People exchange information and experiences to generate and enrich their personal knowledge. Knowledge is important for constructing core competitive advantages for individuals and organizations in today's world (Foss & Pedersen, 2002). In recent years, Web 2.0 applications and social media have provided a convenient environment for people to share their personal knowledge on the Internet. Many people and enterprises also enrich their own knowledge by means of this convenient environment (Cole, 2008).

Online collaborative encyclopedias are one of the most famous Web 2.0 applications for knowledge sharing (Leshed, Haber, Matthews, & Lau, 2008), and are well used by individuals and companies. For instance, Pfizer's pfizerpedia, which is a wiki used in Pfizer's research, provides an environment for the company's employees and partners to build knowledge database (Libert & Spector, 2007). The Social Intranet Study 2011 notes that social media such as blogs, wikis and other tools appear on most of the corporate intranets: 61% have at least one tool available to some or all employees. Among the reasons for the popularity of online encyclopedias is that they can be edited frequently so that they remain up to date (wiseGEEK, 2012), and that the articles are of good quality (Giacomo, 2008). The shared content is also a good resource for knowledge learning.

There are many online encyclopedias that provide a lot of knowledge, and people seek new knowledge from them every day. For instance, Baidu Baike is a Chinese collaborative online encyclopedia with more than 4.9 million articles (Baidu Baike, 2012), surpassing Chinese Wikipedia in this respect. Hudong is the largest Chinese encyclopedia, news, and neologism website in the world. It is the largest wiki site in China with over 6.4 million articles and more than 4.5 million volunteers (Hudong, 2012). It is ranked 55 in China, and most of its readers are college-educated or browse this site at school (Alexa,

\* Corresponding author. Tel.: +886 3 5712121.

E-mail addresses: [yml@mail.nctu.edu.tw](mailto:yml@mail.nctu.edu.tw) (Y.-M. Li), [lienfa0704@gmail.com](mailto:lienfa0704@gmail.com) (L.-F. Lin), [clc0330@gmail.com](mailto:clc0330@gmail.com) (Y.-H. Lin).

2012a). Wikipedia is a free encyclopedia with more than twenty two million articles. According to Alexa's survey in 2012, it is ranked sixth in the world and its readers are often users who browse at work and school (Alexa, 2012b). This indicates the importance of online encyclopedias for seeking and sharing knowledge.

Online collaborative encyclopedias still have several weaknesses, however, in terms of seeking and reusing knowledge resources, and many researchers have identified the disadvantages of online encyclopedias such as Wikipedia (Wu & Wu, 2011). For example, there are several questions which users ask, such as "Which article is important and worth reading?" "What is the concept in related articles?" "How can I get comprehensive understanding of new knowledge by reading just a few articles?" Lacking a practical way to reduce these disadvantages and improve performance, the results would be a waste of time and information overload. As a result, a recommender mechanism of social knowledge navigation which can support people to reuse the huge volume of available knowledge urgently needs to be established.

In order to solve the above problems, this research proposes a novel social knowledge navigation system (SKNS) to support users in knowledge navigation of online free encyclopedias. This study proposes an innovative recommender mechanism of knowledge visualization and navigation which would contains related knowledge findings, judges the importance of knowledge, and offers a visualized knowledge navigation interface. It would construct a more comprehensive view of the knowledge map and highlight the important knowledge flows so people could find knowledge information efficiently. In the proposed system, a knowledge seeker could key in a word and the system would help to find the specific knowledge information required. If the query results were not in accordance with the users' requirements, then the system would generate sub-concepts as suggestions which would direct the user to search again.

The remaining parts of this article are organized as follows. Section 2 of this paper is a review of the related literature on the research topic. Section 3 details the social knowledge navigation recommendation system, which is combined with relevant knowledge network construction, knowledge importance analysis, knowledge concept ontology construction, and a knowledge visualization and navigation interface. An empirical experiment is described in Section 4. Section 5 provides comprehensive experiment results and evaluations. Section 6 concludes and suggests future research directions.

## 2. Related literature

### 2.1. Social media and social knowledge

In recent years, in the light of emerging trends and the growing popularity of social media, researchers have attempted to analyze the characteristics and enhance the practical uses of social media. Social media gives researchers an unprecedented research opportunity (Kwak, Lee, Park, & Moon, 2010). Social media are "a group of Internet-based applications built on the ideological and technological foundations of Web 2.0, that allow the creation and exchange of user-generated content" (Kaplan & Haenlein, 2010). The information created on the social media platforms can be divided into two categories; user-generated content and non-content information (for example the links between articles and user feedback ratings) (Agichtein, Castillo, Donato, Gionis, & Mishne, 2008). Both of these are widely used to extract knowledge and mine hidden information to solve the problem, decision-making, or predict the future (Agichtein et al., 2008; Choudhury, Sundaram, John, & Seligmann, 2008; Stein & Maier, 1995). This kind of content and information is termed 'social knowledge'. For instance, Wikipedia is a form of output of social knowledge; it is a product generated from the wisdom of the crowd. Cheong and Lee (2009) apply artificial intelligence-based data mining approaches to analyze messages on Twitter to find activity trends. Choudhury et al. (2008) analyze the communication dynamics of blogs and use it to determine correlations with stock market movements. Stein and Maier (1995) discuss how to use online forums as a powerful tool for problem solving.

The present research considers that social knowledge is not only a good resource for problem solving or decision-making, but that it also helps people to seek and learn new knowledge. Therefore, this study aims to improve learning effectiveness by utilizing the power of social knowledge in online encyclopedias.

### 2.2. Knowledge relevance and analysis of importance

In today's network environment, a huge amount of user-generated content and non-content information is created on social media platforms (Agichtein et al., 2008). It is important to alleviate information overload on a social media platform and to improve the seeking performance. In order to find the useful knowledge of user generated content, being able to identify high quality of information is an important. Traditionally, information retrieval (IR) techniques were used to improve search performance. Recently, network structure mining techniques, such as link mining, have been successfully used with web hyperlink data in order to evaluate the importance of web pages (Wu & Wu's, 2011; Chiang, Chen, & Yang, 2008). Wu and Wu (2011) utilize internal link analysis to measure the importance of Wikipedia's articles. He, Pei, Kifer, Mitra, and Giles (2010) propose a context-aware citation recommendation system for finding high-quality citation articles. Social network analysis (SNA) pays attention to the relationships between interactive social entities. Graph theory, theoretical concepts and matrix operations act as the foundations of social network analysis (Hage & Harary, 1983). Social rating mechanisms (Sarma, Sarma, Gollapudi, & Panigrahy, 2010), allow users to evaluate the quality of nearly anything (e.g. blog posts, books, movies, hotels, etc.). Agichtein et al. (2008) explores methods of using community feedback (ratings) to automatically recognize essential and high-quality content. Social rating systems are increasing in popularity among commercial sites (e.g. Digg.com, Amazon.com and Netflix.com).

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