International Journal of Business, Human and Social Sciences
ISSN: 2517-9411
Vol:4, No:12, 2010

Knowledge Relationship Model among User in Virtual Community

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***Abstract*—**With the development of virtual communities, there is an increase in the number of members in Virtual Communities (VCs). Many join VCs with the objective of sharing their knowledge and seeking knowledge from others. Despite the eagerness of sharing knowledge and receiving knowledge through VCs, there is no standard of assessing ones knowledge sharing capabilities and prospects of knowledge sharing. This paper developed a vector space model to assess the knowledge sharing prospect of VC users.

***Keywords*—**Knowledge sharing network, Virtual community, knowledge relationship, Vector Space Model.

I. Introduction

NO one can ever deny the significance of electronic communication techniques which contribute to changing the overall picture of social communication methods. They have greatly accelerated the speed, size and ease of human communication. These new electronic techniques such as E-mail, forums and newsgroup, etc. have given rise to new social groups which names Virtual communities. Virtual community gathers people with the common interest and goals as "virtually" from all over the word to interact, communicate and share their knowledge [1]. It makes environment for people to contribute their knowledge and acquire valuable knowledge to fulfill their needs from VCs. Knowledge sharing seems to be the most important reason for participating in VCs [2].

Members are the most important resource for actual knowledge of VCs. They must interact with each other in order to obtain and share knowledge. In general the significance of social context to knowledge sharing has been accepted by researchers [3]-[4]-[5]-[6].

According to cognitive theories, an individual can only contribute knowledge he/she knows, which is currently a part of his/her cognitive structure. He/she can acquire knowledge if it is comprehensible, given his current cognitive structure [8]-[11]. Thus there is more possibility that members with similar knowledge structure are eager and capable to share knowledge with each other in VCs. Thus knowledge relationship among members should be considered in investigating knowledge sharing in VCs, but this part was often neglected in previous studies on knowledge sharing in VCs.

In this paper, we focused on the network, forming in VC members' knowledge sharing interactions, named knowledge sharing network and we tried to purpose a model to investigate members' knowledge sharing behavior in VCs with integrating knowledge relationship factor.

II. Virtual Community and Knowledge Sharing Network

The important reason for participating in VCs is knowledge sharing. Knowledge sharing requires interaction between contributor and consumer of knowledge. Each member can be a contributor or requester as they have own knowledge in knowledge sharing interactions. Thus knowledge relationship could be a metric used to measure the degree of contributor's knowledge being similar with requester's knowledge structure. Based on the above explanation, our model will explain as follow:

A: The individual knowledge structure for each member is based on the tags added by him/her self and rating from others to his/her posting in past knowledge sharing interactions.

B: Knowledge relationship between each member is evaluated by calculating the similarity of their knowledge structure.

The next step is how to calculate knowledge relationship.

III. Calculating the Knowledge Relationship of Knowledge Sharing Network in Virtual Communities

When we talk about knowledge we should consider both sides, tacit and explicit knowledge. Tacit knowledge is more difficult to code, eloquent, and transfers from the owner's mind. In contrast, explicit knowledge can be expressed into signs, text and words, so it can be more easily codified and documented. [12].

By the mean time, measuring knowledge would be more problematical by its intangible nature, especially measuring tacit knowledge. However, when tacit knowledge is transformed into explicit knowledge through socialization or interaction [12]-[15] and shared by members of an organization, measuring the knowledge can be made.

In VCs, members interact with each other to share their knowledge mainly through posting and replying. Although these posts and replies themselves by definition do not contain tacit knowledge, they point to those who own knowledge related to the content and reflects their knowledge status [13]-[14]. The individual knowledge structure construction starts from a collection of posting and replying documents related to a user. The most common way to represent text document in

an automated text mining system is Vector Space Model [16]. In this model, each text document is transformed into a vector with the entire vocabulary of the document body as dimensions. The document vector contains a weight for each of these dimensions. If a weight is 0 indicates that word from the vocabulary is not present. However, this simple word-count based method is not accurate to represent the actual knowledge express in the document. Thus many semantic analysis methods are developed for this reason. In our research, we used to figure out the user's knowledge structure by rating information of these posting and replying related to a user. Tagged post or reply, counted and rated during members interaction can be used to figure out each member's knowledge status more precisely, tags added by the author indicate the knowledge domains the member is proficient at and ratings from other members represent his/her proficiency level in these knowledge domains. After identification of the posted documents relevant to a VC member, they are used to profile users' knowledge structure. For a document Di, the knowledge shown in it can be expressed using a knowledge vector KDi as in (1):

$$KD_i = [L_{i1}, L_{i2}, L_{i3}, \dots, L_{in}]^T \quad (1)$$

Lij: Proficiency level in knowledge domain j of the knowledge in document Di
N: Number of knowledge domains

Our approach is to make a single weighted knowledge vector, by making a normalized linear combination of the knowledge vectors that are associated with the involved documents related to a VC member. This will represent as Lkj which will show the proficiency level in knowledge domain j of VC member k and it be calculated as the following (2)

$$L_{kj} = \frac{1}{M} \sum_{m=1}^{M} L_{mj} \quad (2)$$

K: VC member
J: knowledge domain
Lmj: VC member k's proficiency level in knowledge domain j exist in document Dm
M: the number of documents related to VC member k
Then next step is show the knowledge structure of VC member k that can be expresses by using a knowledge vector as follow (3)

$$X_k = [L_{k1}, L_{k2}, L_{k3}, \dots, L_{kn}]^T \quad (3)$$

The result of this is a new knowledge vector in the same vector space as the document knowledge vectors.

If the member is newcomer, there is no reviewing and replying record so to overcome this problem, his/her proficiency level in each knowledge domain is set to a medium value. Then the knowledge relationship between member i and j can be calculate by the similarity between their knowledge structure represented using knowledge vectors Xi and X j as in (4)

$$K_R - R(i,j) = \cos\theta = \frac{X_i \cdot X_j}{IX_i\, I\, IX_j\, I} \quad (4)$$

Knowledge transferring will be easier if the knowledge requester and knowledge contributor share more common knowledge, i.e., they have more similar knowledge structures. On the other hand, if the knowledge structure of knowledge contributor is very similar to that of the knowledge requester, then what can be transferred is limited.

IV. Conclusion

To acquire and share knowledge, VC members must interact with each other. As the members interact, they become more and more familiar with each other, their knowledge structures co-evolve over time, and a multiple-relationship network, named knowledge sharing Virtual network, is formed among members. At the heart of each community lies a social network which affects members' knowledge sharing behavior. In this paper, knowledge relationship of the network was modeled by Vector Space Model. In prior studies on knowledge sharing in VCs, the knowledge relationship was often neglected.

In this paper, our work was focused on the modeling of a component of knowledge sharing Virtual network .What we proposed in this paper is just a model of the knowledge relationship in knowledge sharing Virtual network in VCs. The application of the model to extracting the network from practical Virtual Community web sites need to be considered carefully.

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