# Visualization of Social Relationship using Dynamic Hierarchy Analyzing

Jun Woo Shin[4], Sun Park[1], Beommu Kim[2], Sang Heuck Park[1], Bold Sanja[3], Huyeol Yang[1], Seong Ro Lee[1]

[1,2,3]Mokpo National University, South Korea, [4]National IT Industy Promotion Agency, South Korea
[1]{sunpark, parkshyuk, yang, srlee}@mokpo.ac.kr, [2]ktiger1907@gmail.com, [3]snj_goopy@yahoo.com, [4]sjw@nipa.kr

**Abstract.** This paper proposes a visualization method to represent user social relationship using dynamic hierarchy method for analysis of social network service. The proposed method uses internal relationship of user correlation and external relation of network node to construct hierarchy relationship by dynamic hierarchy method which can intuitively understand user's interaction.

**Keywords:** SNS (social network service), social network analysis, visualization, correlation, user relationship, dynamic hierarchy.

## 1 Introduction

Recently, the approaches of visualizing social network (SN) including node-link (NL) based methods [1], matrix graph (MAT) based representations [2], and a hybrid based visualizations with NL and MAT [3, 4] have been proposed. The NL based approach can be usefully displayed by the overall structure of a network. However details about dense sub-graphs of the NL methods are difficult to read. To overcome the readability problem of the NL based methods, the MAT based approaches are proposed. These methods can well identify the network nodes in comparison with the NL based methods. But, the methods are poor for path-finding tasks since it is difficult to understand nodes in connection with representing matrix graph [2, 3]. MatLink [3] and MatTrix [4] are hybrid based methods. MatLink method is proposed to overcome a problem of NL and MAT based approaches. Nevertheless, the hybrid based techniques also showed that it is difficult to understand relationship between users [1, 2, 3, 4]. In the above approaches, it is difficult to intuitively understands important of social networks focusing on user because the works use the complicated multi-dimension graph and matrix to visualize nodes in relation to user's interaction on social network. Also, most of the visualization methods are inadequate to reflect user message into user's interaction since they use only an amount of access information on social network for representation of user's relationship.

In order to resolve the limitation of the graph and matrix based visualization approaches, this paper proposes a new visualization method which uses internal

relationship of user correlation and external relation of social network to visualize user relationship hierarchy.

## 2 The Proposed Method

The proposed method consists of preprocessing, node relation, and visualizing user relationship.

### 2.1 Preprocessing

In preprocessing phase, social network information is obtained for next phase of calculating user relationship. The preprocessing phase consists of two steps. In first step for internal relationship, after the given user's messages on SN are decomposed into individual user's message set, the stop words are removed, and word stemming is removed [5]. Then the user-term frequency matrix $M$ is constructed from user's message set. Let $M$ be $m \times n$ users by terms matrix, where $m$ is the number of users and $n$ is the number of terms. The element of matrix $M$, $M_{ij}$ represents $i$'th user frequency of $j$'th term [6]. In second step, the access information of social network topology (i.e., mention information, node direction, period, size, etc.) is extracted for external relation.

### 2.2 Node Relation

This phase consists of calculating internal relationship and computing external relation for constructing user relationship hierarchy of social network. The internal relationship represents correlation between users which is derived from the user's message of social network. The external relation means the relation between nodes on social network topology with regarding to users. The internal user correlation is derived from user-user correlation matrix. User-user correlation matrix is calculated by a correlation between users and user-term frequency matrix [6].

### 2.3 Visualizing user relationship

In this section, user relationship hierarchy is visualized by using sum of internal relationship and external relation for social network analysis as follows. First, user-user correlation matrix is reconstructed by using sum of internal relationship and external relation. Second, user correlation graph is constructed by user-user correlation matrix. Third, a constant of internal and external is calculated by average of user element values of user-user correlation matrix. Fourth, user relationship hierarchy is visualized by the user correlation graph and the constant. Final, whenever a social network analyzer is dissatisfied with the results of the visualizing user relationship hierarchy, the user relationship hierarchy can be dynamically reconstructed to adjust a constant range.

## 3 Conclusions

The proposed method has following advantages. First, the method can well represent user-focused relationship hierarchy on social networks by using user correlation between user's messages. Second, the importance of access node reflects into user relationship hierarchy by exploiting external relation. Third, the user relationship hierarchy is dynamically constructed by controlling a constant of internal and external relation. Finally, our proposed method can well understand user relationships on account of representing user relationship hierarchy from social networks.

## Acknowledgement

This work was supported by the National Research Foundation of Korea Grant funded by the Korean Government (NRF-2012S1A5A2A01014422), "This research was supported by the MKE (The Ministry of Knowledge Economy), Korea, under the ITRC (Information Technology Research Center) support program supervised by the NIPA (National IT Industry Promotion Agency)"(NIPA-2012-H0301-12-2005).

## References

1. Ghoniem, M. Fekete, J. D. Castagliola, P.: On the readability of graphs using node-link and matrix based representations, a controlled experiment and statistical analysis, Information Visualization, Vol. V, No. 2, 114-143 (2005)
2. Wasserman, S. Faust, K.: Social Network Analysis, Cambridge University Press, Cambridge, (1994)
3. Henry, N. Fekete, J.-D.: MatLink: Enhanced Matrix Visualization for Analyzing Social Networks, LNCS 4663, Part II, 288-302 (2007)
4. Henry, N. Fekete, J.-D. McGuffin, M. J.: NodeTrix: a Hybrid Visualization of Social Networks, IEEE Transactions on Visualization and Computer Graphics, Vol. 13 Issue:6, 1302-1309 (2007)
5. Frankes, W. B. Baeza-Yaes, R.: Information Retrieval: Data Structure & Algorithms, Prentice-Hall, (1992)
6. Ricardo, B. Y. Berthier, R.-N. Modern Information Retrieval the concepts and technology behind search second edition, Addision Wesley, (2011)