

Analyzing Participation of Students in Online Courses Using Social Network Analysis Techniques

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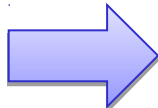
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Introduction



- Growing number of e-learning courses
- Online discussions important in collaborative learning
- Thousands of messages generated in a few months
- Evaluating the participation of students
- ➡ Current e-learning environments do not provide much information regarding the structure of interactions between students
- Applying social network analysis (SNA) techniques to study these interactions and evaluate participation of students
- Social networks generated from
 - Student communications
 - content of the exchanged messages
- MeerkatED: facilitates evaluation of students' participation

Organization

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- Background
 - Social Network Analysis (SNA)
 - SNA of Asynchronous Discussions in Online Courses
 - Social Network Analysis for Education: MEERKAT-ED
 - Interpreting Students Interaction Network
 - Interpreting Term Network
 - Case-study
 - Interpreting Students Interaction Network
 - Interpreting Term Network
 - Conclusions

Social Network Analysis

Social networks: a set of **actors** or network members whom are tied by one or more type of **relations**

- persons, organizations, web pages, proteins, documents, ...
- collaborations, friendships, web links, citations, information flow, ...

*"causation is not located in the individuals,
but in the social structure"*

Social network analysis is the study of this *structure*

- **Interdisciplinary area of study:** anthropology, communications, computer science, education, economics, criminology, management science, medicine, political science, ...



Social Network Analysis (cont.)

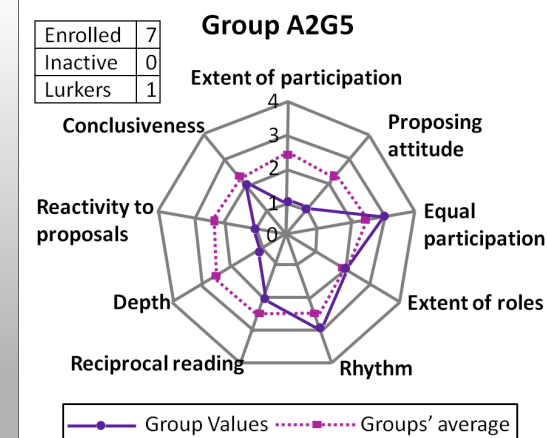
Social network analysis examines the structure and composition of ties in the network to provides insights into:

- Understanding the central actors in the network (prestige)
- Detecting the individuals with
 - The most outgoing connections (influence)
 - The most incoming connections (prominence)
 - The least connections (outlier)
- Identifying the proportion of possible ties that actually exist (density)
- Tracking the actors that are involved in passing information through the network (path length)
- Identifying the actors that are communicating more often with each other (community)

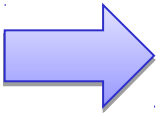
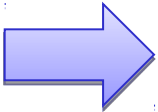


SNA of Asynchronous Discussions in Online Courses

- **Extraction** of Social Network from Discussion threads
 - Log files, **back-up** files or connected module
 - Each message as directed to all participants in that discussion thread
 - Laghos et al. 2006
 - Only directed to the previous message
 - Common method: de Laat et al. 2007, Willging 2005, Erlin et al. 2009
 - More complicated methods
 - Name Network by Gruzd and Haythornthwaite 2008 and 2009
- **Measuring** the effectiveness of participation
 - General social network measures in generic SNA toolboxes
 - Sundararajan 2010, de Laat et al. 2007, Willging 2005, Erlin et al. 2009 used UCINET[UCINET] and Laghos and Zaphiris 2006 used NetMiner [NetMiner]
 - High level indicators
 - Daradoumis et al. 2006
 - In the education context, Calvani et al. 2009
- **Presentation** of the result



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SOCIAL NETWORK ANALYSIS FOR EDUCATION: MEERKAT-ED



Meerkat-ED: exploits social network analysis techniques including community mining to discover relevant structures in

- Social networks generated from **student communications**
- Information networks produced from the **content of the exchanged messages**

Provides better means to assess participation in the online discussions by **visualization of discovered structures + automated identification of central and peripheral participants**

- Overall snapshots of participants and their interactions
- Leader/peripheral students
- Hierarchical summarization of the topics
- How much each student has participated on these topics

Interpreting Students Interaction Network

Monitoring the interaction structure of students

- Nodes represent students
- Edges are the interactions i.e. messages exchanged
 - Connecting the author of the message to the author of its parent message
 - Weighted & Directed

‘Nodes’ centrality measures their relative importance within a network”

Examining the leader/peripheral students

- The leadership and influence of students is compared by examining the centrality of the nodes corresponding to them in the network
- Ranked more explicitly in a concentric centrality graph
 - the more central/powerful the node is, the closer it is to the center



Interpreting Term Network

Depicts the **terms used in the discussions** and the relation between these terms

- Nodes represent noun phrases occurring in the discussions
- Edges show the co-occurrence of these terms in the same sentence
 - Undirected & weighted

“Topic: terms co-occurring mostly together”

Finding the hierarchical communities in this network, demonstrates the **topics** exchanged in the discussions


- Choosing each of these topics would outline the **students who participated in that topic and the extent of their participation**



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CASE STUDY

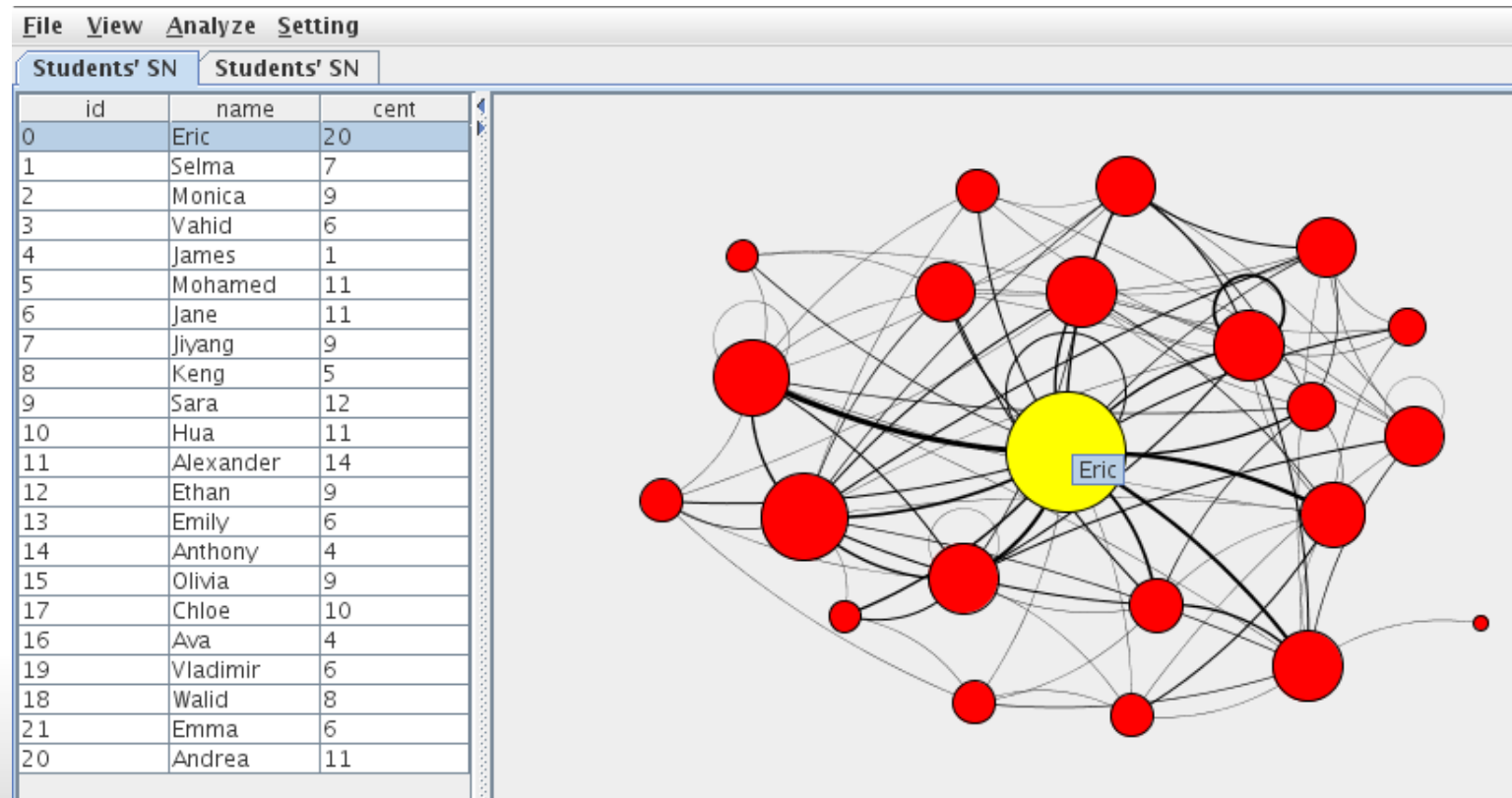
A postsecondary course offered in Winter 2010 at University of Alberta using Moodle

- Anonymized by assigning fake names
- The instructor initiated different questions or provided some information and asked students to discuss the issue.
- Students posted subsequent messages in the thread, responding to the original question or to the response of other students

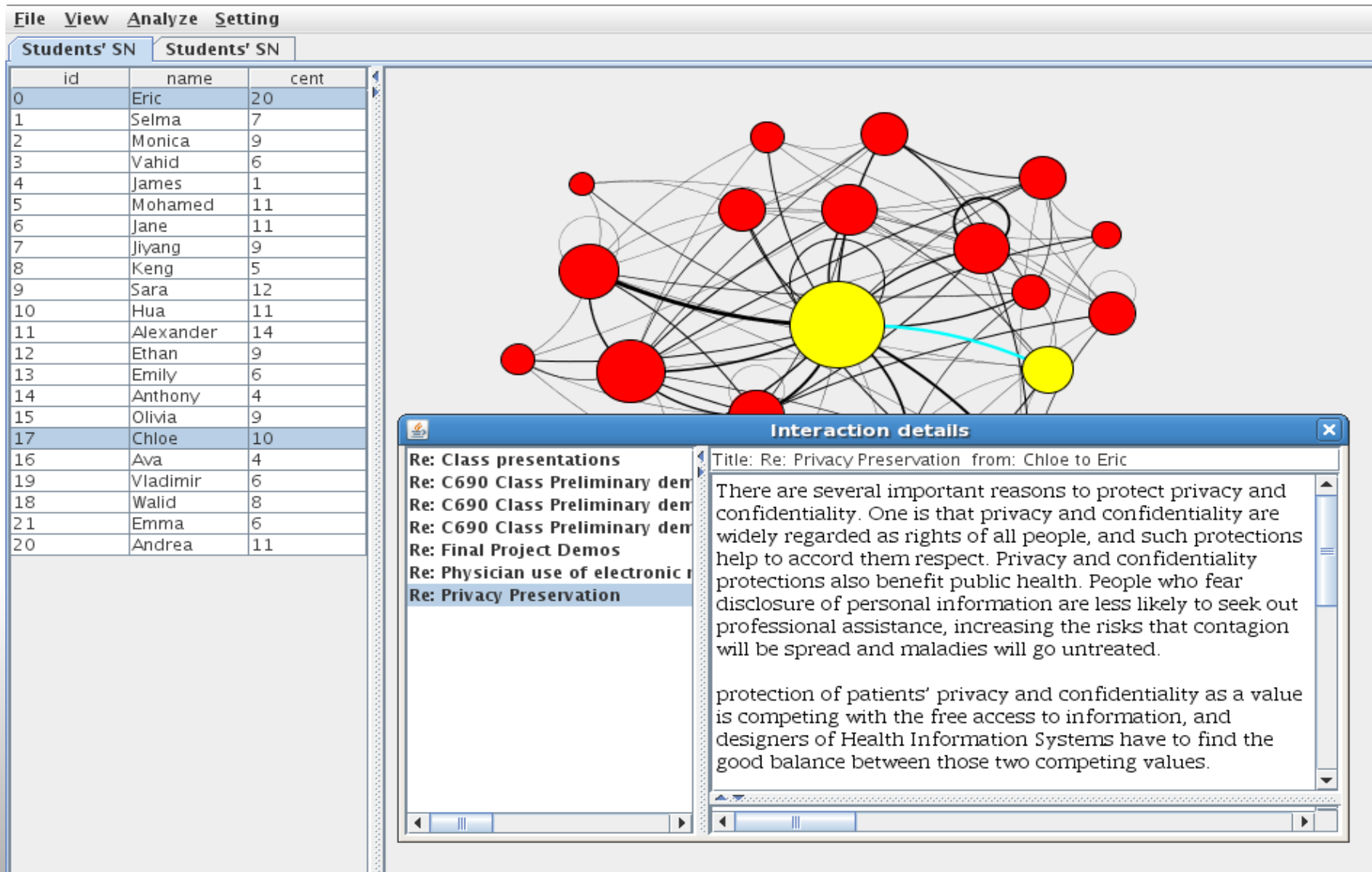
“An overview of the whole participation with the ability to Identify influential students in each thread as well as identify quiet students or unvoiced opinions, something that would have been impossible with the simple statistics provided by Moodle”



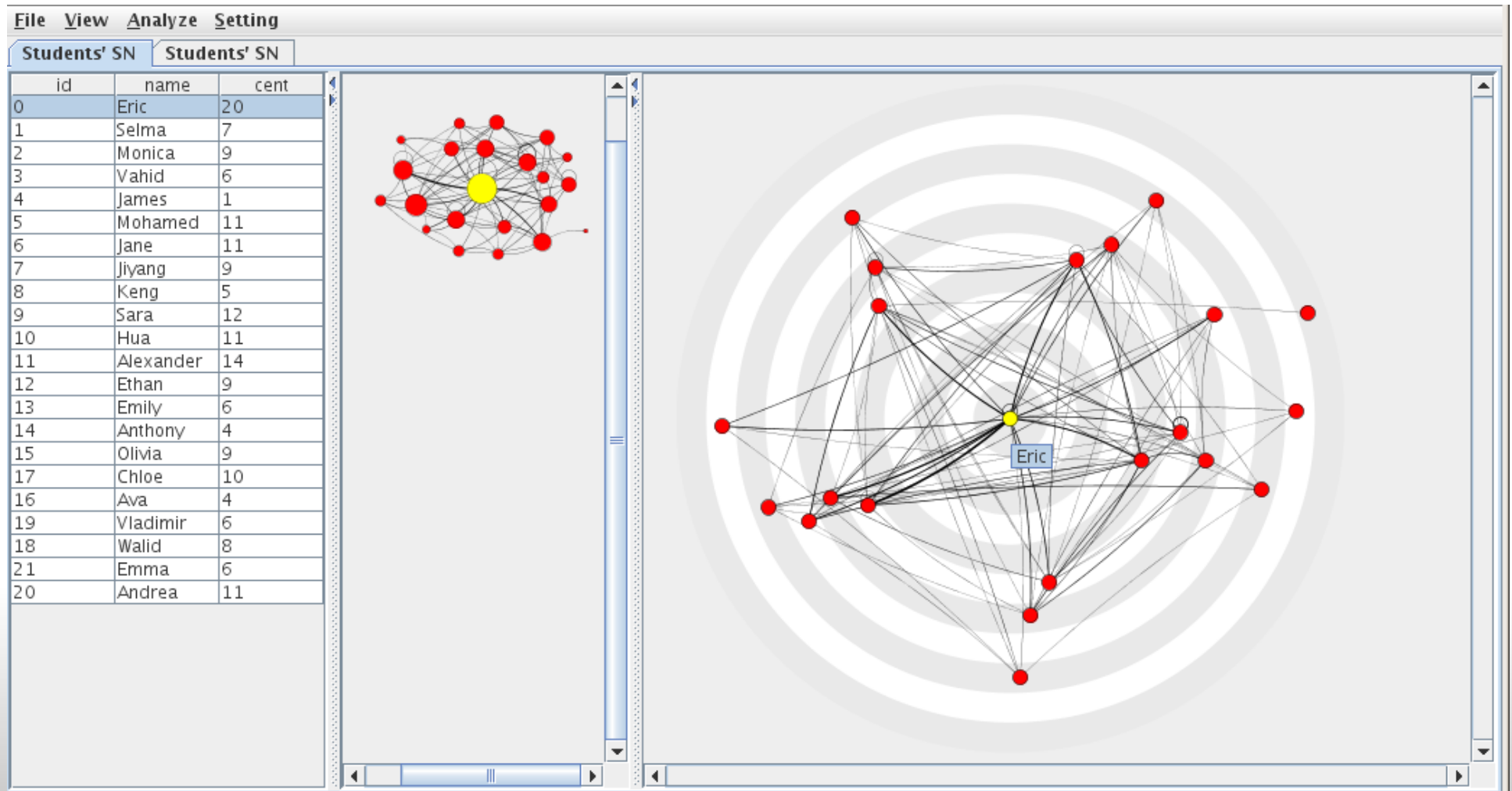
Interpreting Students Interaction Network



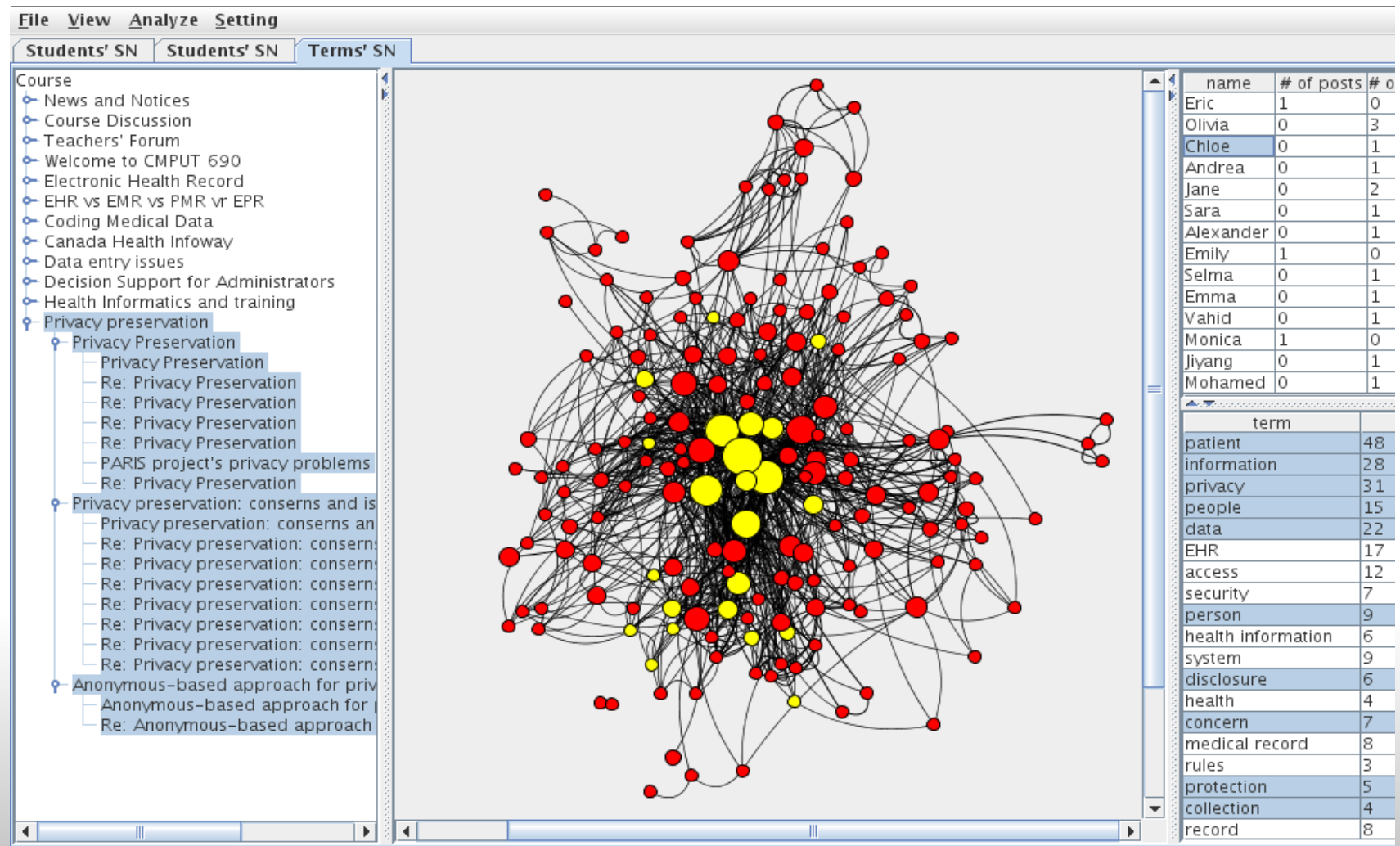
Visualization of messages in an interaction



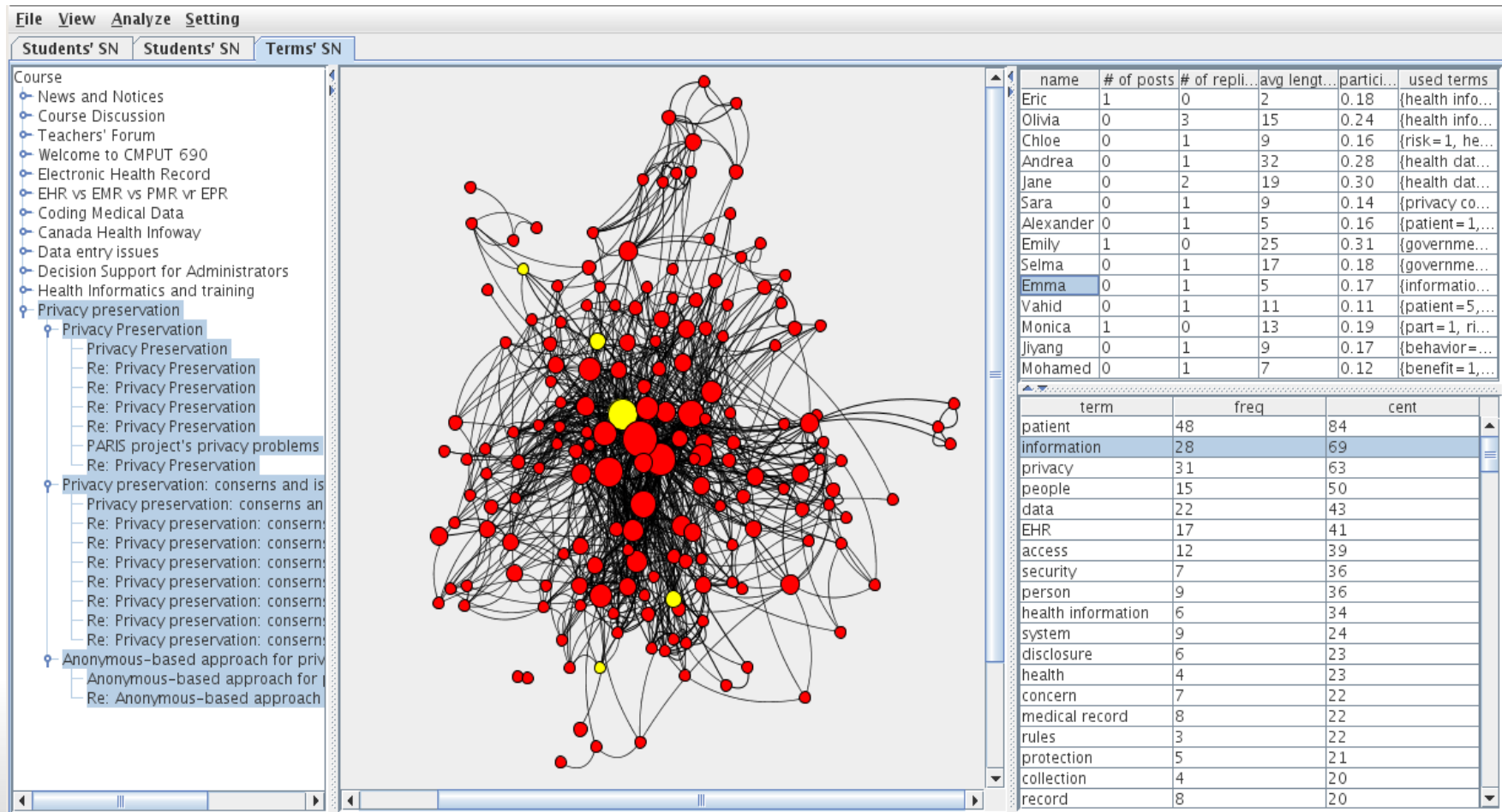
Comparing centrality of students



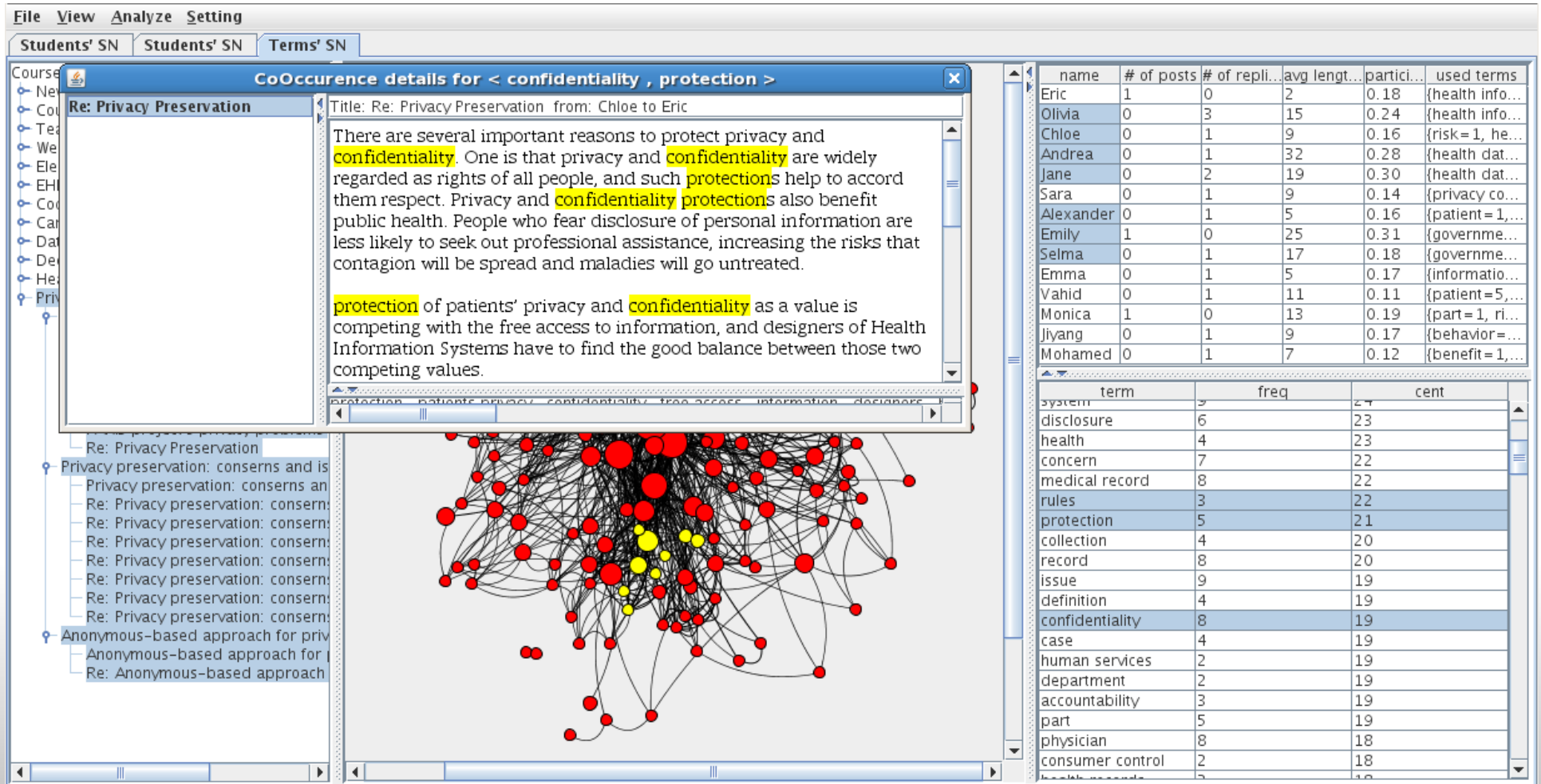
Interpreting Term Network



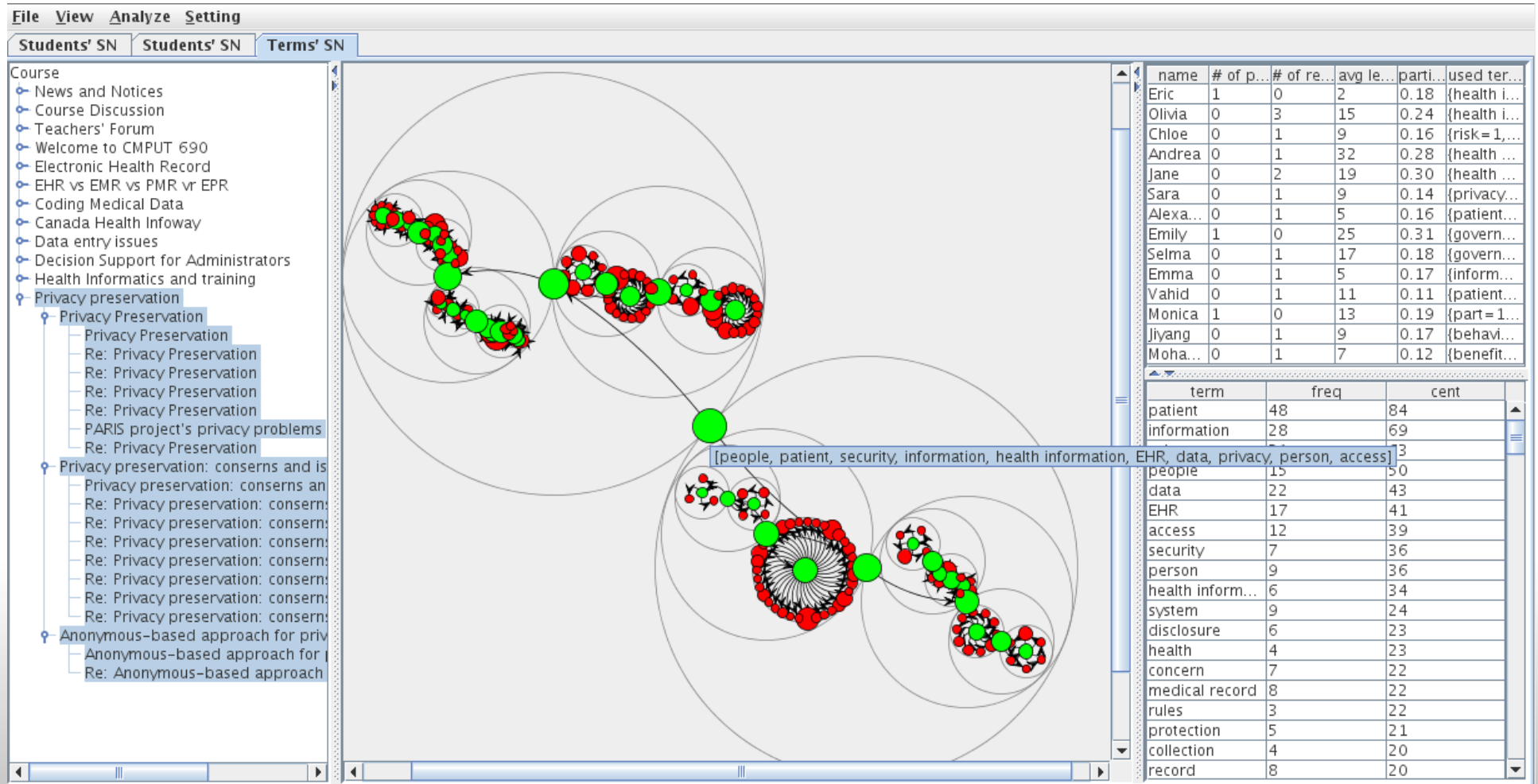
Interpreting Term Network



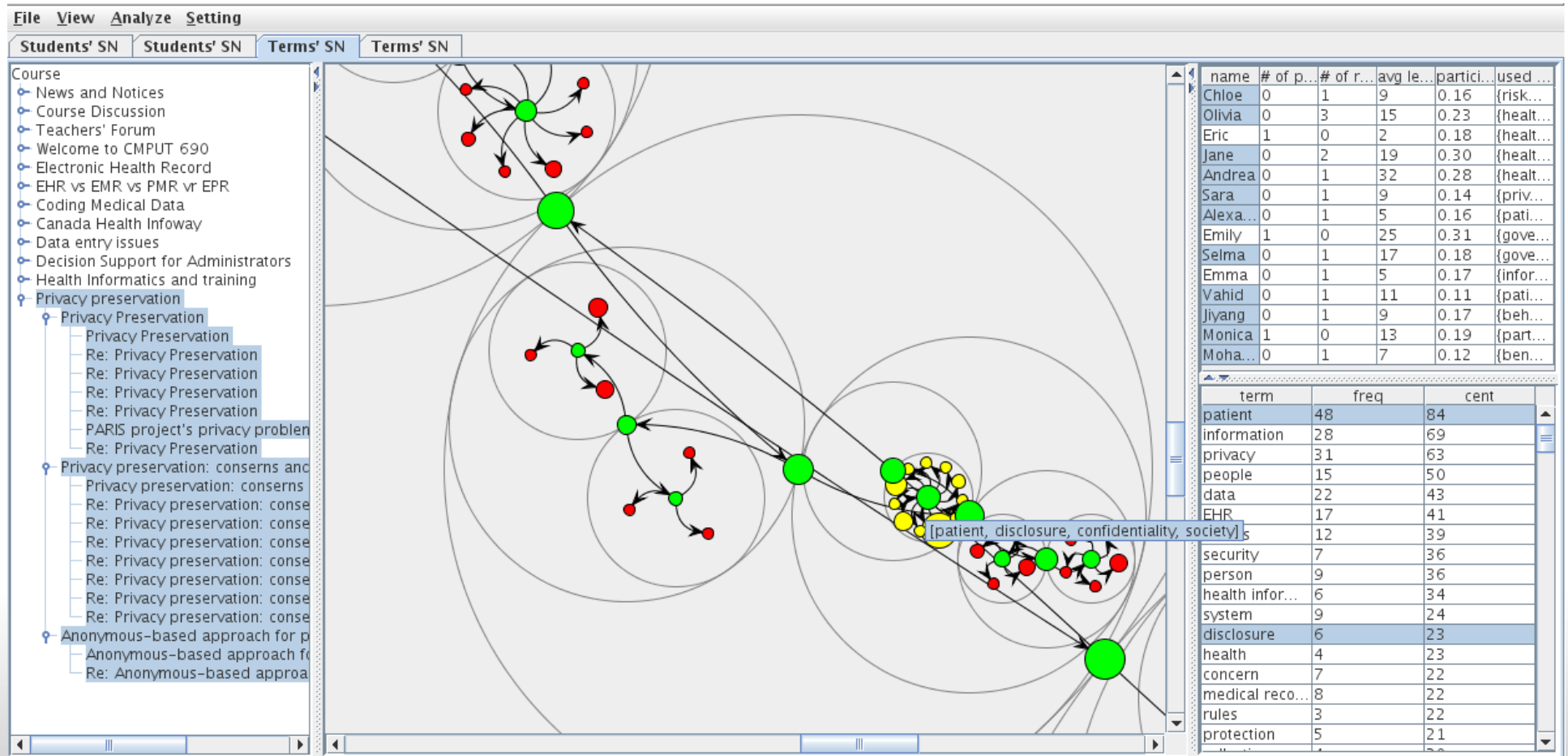
Co-occurrence of terms



Term communities (Topics)



Term communities (Topics), Closer Look



CONCLUSIONS, Questions?

The importance of **social network analysis** for mining structural data and its applicability in the domain of **education**

- The place and need for social network analysis in study of the interaction of users in e-learning environments

Meerkat-ED, a specific and practical toolbox for analyzing students interactions in asynchronous discussion forums

- Prepares and visualizes overall snapshots of **participants** in the discussion, their **interactions**, and **the leaders/peripheral students**
- Creates a hierarchical summarization of the **discussed topics**
- Illustrates **individual student participation** in these topics

Exploiting the mining abilities of this toolbox would facilitate fair evaluation of students' participation in online courses