NetLearn: Social Network Analysis and Visualizations for Learning

Theresa Devi Indriasari

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RWTH Aachen

Prof. Dr. Marcus Specht

Open University
Heerlen
Outline

Introduction

Social Aspect of Learning
Expertise Finding and Community Mining
Thesis Work

State-of-the-art
Requirements
Implementation
Evaluation
Conclusion and Future Work
Social Aspect of Learning

Social Learning Theories: e.g.
- Situated learning (Lave and Wenger)
- Activity theory (Vygotsky, Engeström)
- Connectivism (Siemens)
Expertise Finding and Community Mining

- Information overflow in Web 2.0 → Hard to find valuable information
- Shift from learn-what to learn-who
- Locate the person or community who has the needed information → tools for expertise finding and community mining
- Social Network Analysis and Visualization tools
Thesis Work: NetLearn

- Use Social Network Analysis and Visualization techniques for:
  - Analysis and visualization of learning communities
  - Expertise finding and community mining
- PROLEARN co-authorship network
- Data from PROLEARN Academy publication database
Outline

Introduction

**Related Work**

Requirements
Implementation
Evaluation
Conclusion and Future Work
### Related Work

<table>
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<tr>
<th>Systems</th>
<th>searching by keyword</th>
<th>searching by author's name</th>
<th>searching by research interest</th>
<th>finding path (seeker and expert)</th>
<th>author clustering</th>
<th>keyword clustering</th>
<th>network filtering</th>
<th>local communities visualization</th>
<th>interactive visualization</th>
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</table>
Outline

Introduction
State-of-the-art
Requirements
Scenarios
System Requirements
Abstract Architecture
Use Cases
Implementation
Evaluation
Conclusion and Future Work
Scenarios

1. Ferry tries to find an expert or locate a community working on "mobile learning".
2. Ferry sees the local network of an expert.
3. Ferry finds a path to the expert.
4. Ferry finds communities based on interest area entry.
5. Ferry sees the co-authorship network clustered by keyword.
6. Ferry finds communities based on keyword entry.
7. Ferry sees a graph visualizing the co-authorship network.
8. I am not expert in "mobile learning".

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System Requirements

- Basic Visualizations Requirements
  - Intensity Visualization
  - Toolbar View
  - Statistic Information
  - Publication Information
  - Researchers’ Local Network
- Community Mining Requirements
- Expertise Finding Requirements
System Requirements

- Basic Visualizations Requirements
- Community Mining Requirements
  - Author Mining
  - Keyword Mining
- Expertise Finding Requirements
System Requirements

- Basic Visualizations Requirements
- Community Mining Requirements
- Expertise Finding Requirements
  - Local Author
  - Keyword Community
  - Interest Community
  - Referral Chain
Abstract Architecture
Use Cases
Outline

Introduction
State-of-the-art
Requirements

**Implementation**
- Architecture
- Technologies and Tools Used
- Storage
- Analysis and Visualizations
- Community Mining
- Expertise Finding

Evaluation
Conclusion and Future Work
Architecture

Technologies and Tools Used
- Storage
- Analysis and Visualizations
  - Community Mining
  - Expertise Finding

Introduction
State-of-the-art
Requirements
Implementation
Evaluation
Conclusion and Future Work
Technologies and Tools Used

- yFiles
- Java Enterprise Edition
  - JSP
  - JavaScript
  - JFreeChart
  - Java Applet
  - Apache Tomcat
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Introduction  
State-of-the-art  
Requirements  
Implementation  
Evaluation  
Conclusion and Future Work

Storage  
Architecture  
Technologies and Tools Used  
Storage  
Analysis and Visualizations  
Community Mining  
Expertise Finding

Community Mining  
Expertise Finding

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Analysis and Visualizations (y.base, y.view, y.layout)
Author Mining

Zoom In | Zoom Out | Fit Content | Circular Layout | Hierarchic Layout | Organic Layout | Orthogonal Layout

Zoom In | Zoom Out | Fit Content | Circular Layout | Hierarchic Layout | Organic Layout | Orthogonal Layout

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## Author Mining

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Author Mining

Introduction
State-of-the-art
Requirements
Implementation
Evaluation
Conclusion and Future Work

Author Mining

Technologies and Tools Used
Storage
Analysis and Visualizations
Community Mining
Expertise Finding

NetLearn: Social Network Analysis and Visualizations for Learning
Keyword Mining

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<td>semantic web</td>
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NetLearn: Social Network Analysis and Visualizations for Learning

Theresia Devi Indriasari
Introduction
State-of-the-art
Requirements
Implementation
Evaluation
Conclusion and Future Work

Architecture
Technologies and Tools Used
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Local Author

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NetLearn: Social Network Analysis and Visualizations for Learning
## Keyword Community

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<thead>
<tr>
<th>Index</th>
<th>Keyword</th>
<th>Title of Publications &amp; Authors</th>
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| 8     | knowledge management | *The future of e-learning: a shift to knowledge networking and social software*  
(M. A. Chatti, M. Jarke, D. Frosch-Wilke)  
Appeared in: Int. J. Knowledge and Learning, Vol. 3, Nos. 4/5, 2007  
Type of publication: Journal Article |
| 31    | e-learning          | *The future of e-learning: a shift to knowledge networking and social software*  
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Appeared in: Int. J. Knowledge and Learning, Vol. 3, Nos. 4/5, 2007  
Type of publication: Journal Article |
| 76    | communities         | *The future of e-learning: a shift to knowledge networking and social software*  
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Appeared in: Int. J. Knowledge and Learning, Vol. 3, Nos. 4/5, 2007  
Type of publication: Journal Article |
| 99    | learning management | *The future of e-learning: a shift to knowledge networking and social software*  
(M. A. Chatti, M. Jarke, D. Frosch-Wilke)  
Appeared in: Int. J. Knowledge and Learning, Vol. 3, Nos. 4/5, 2007  
Type of publication: Journal Article |
## Interest Community

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<td>1.2</td>
<td>M. A. Chatti, R. Klamma, M. Jarke, A. Naeve</td>
<td>The Web 2.0 Driven SECI Model Based Learning Process</td>
<td>The main aim of Knowledge Management (KM) is to connect people to quality knowledge as well as people to people in order to peak performance. This is also the primary goal of Learning Management (LM). In fact, in the world of e-learning, it is more widely recognised that how learning content is used and distributed by learners might be more important than how it is designed. In the last few years, there has been an increasing focus on social software applications and services as a result of the rapid development of Web 2.0 concepts. In this paper, we argue that LM and KM can be viewed as two sides of the same coin, and explore how Web 2.0 technologies can leverage knowledge sharing and learning and enhance individual performance whereas previous models of LM and KM have failed, and present a social software driven approach to LM and KM.</td>
<td>knowledge management; KM; learning management; e-learning; communities; Web 2.0; social software; knowledge networking; online learning; knowledge sharing</td>
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<td>3</td>
<td>M. A. Chatti, M. Jarke, D. Frosch–Wilke</td>
<td>The future of e–learning: a shift to knowledge networking and social software</td>
<td>This article presents ICamp â€“ innovative, inclusive, interactive &amp; intercultural learning Campus â€“ as the first implementation of an actual Next Generation Educational Web, supported by the emergent Web 2.0 paradigm and the technologies surrounding it. This lecture (conference/poster) is intended to show you how the key elements under this blurry umbrella–like concept of Web 2.0 permeate the educational domain, allowing us to develop a brand–new learning environment upon a series of innovative pedagogical models, beyond the constructivist approach thought of as the basis for the higher education in an enlarged Europe.</td>
<td>Keywords: Web 2.0, Internet, eLearning.</td>
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<td>A. Fumero</td>
<td>EDUWEB 2.0 – ICamp &amp; N–Gen Educational Web.</td>
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Referral Chain
Introduction
State-of-the-art
Requirements
Implementation
Evaluation
Evaluation Methodology
Evaluation Result
Conclusion and Future Work
Figure: DeLone and McLean’s I/S Success Model [JOPP98]
Evaluation Result

- 20 questionnaires sent out, 18 returned
- Responders:
  - 10 are computer science and electrical engineering students in Europe and Asia
  - 1 Manager in Indonesia
  - 3 Informatics lecturers in Indonesia
  - 1 researcher at Uni Bonn
  - 3 researchers at Manchester University

Familiarities with Social Network Theory and SNA Tools

- Yes: 17%
- No: 83%
## Evaluation Result

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**NetLearn: The Visualizations Are Helpful**

- Blue bars: Author Mining Module
- Purple bars: Keyword Mining Module
- Yellow bars: Local Author Module
- Red bars: Keyword Community Module
- Orange bars: Interest Community Module
- Brown bars: Referral Chain Module
Evaluation Result

NetLearn: Final Remarks

NetLearn: The Most Useful Visualization

- Author Mining: 2 (Most Useful), 3 (Useful)
- Keyword Mining: 9 (Most Useful), 4 (Useful)
- Local Author: 1 (Most Useful), 2 (Useful)
- Keyword Community: 2 (Most Useful), 6 (Useful)
- Interest Community: 3 (Most Useful), 3 (Useful)
- Referral Chain: 1 (Most Useful), 0 (Useful)
Furthermore, several responders gave some suggestions:
  – provide the ability to read other database than PROLEARN
  – give more explanation about the meaning of centrality measures especially for those who are new to SNA
  – give more explanation about the layout
  – give more explanation about the outcome of each module
  – have some progress indicator on the java applet to show that the graph is loading.
Outline

Introduction
State-of-the-art
Requirements
Implementation
Evaluation

Conclusion and Future Work

Conclusion
Future Work
Conclusion

- Learning „who“ instead of „what“
- SNA and SNV as methods to understand networks of people
- Co-authorship relationship
- Analyze and visualize learning communities, find experts, locate communities
- 6 modules: author mining, keyword mining, local author, keyword community, interest community, referral chain
- Some of the NetLearn results have been used for the Prolearn final review, e.g.
  - Evaluation of Prolearn network between 2004 and 2007
  - The most central Prolearn researchers
Future Work

- Database
- Technology used
Demo
Questions and Answers