Classification Techniques for Assessing Student Collaboration in Shared Wiki Spaces

Chitrabharathi Ganapathy, Jeon-Hyung Kang, Erin Shaw, and Jihie Kim

Southern California, Information Sciences Institute
4676 Admiralty Way, Marina del Rey, CA, 90292 USA
{cganapat,jeonhyuk}@usc.edu, {shaw,jihie}@isi.edu

Abstract. This paper presents the case study of collaboration analysis in the context of an undergraduate student engineering project. Shared Wiki spaces used by students in collaborative project teams were analyzed and the paper presents new techniques, based on descriptive statistics and the Labeled Latent Dirichlet Allocation (LLDA) model for multi-label document classification, to assess quality of student work in shared wiki spaces. A link is shown between processes of collaboration, performance and work pace.

Keywords: Collaborative learning assessment, Wiki Assessment, Topic Modeling, Labeled Latent Dirichlet Allocation, Descriptive Statistics.

1 Introduction

Wikis are collaborative knowledge building environments that have been shown to promote collaborative learning [1][2][3], however, the results of Wiki use in academia have been mixed [1][4],and patterns of student Wiki use in engineering courses and their effect on learning have been challenging to assess. The goal of the work presented here is to make progress towards closing the 'assessment' gap, that is, to develop techniques to assist instructors and educational researchers in evaluating student performance in the context of an on-line collaborative learning environment, the shared Wiki space.

2 Wiki Document Classification and Assessment Using Labeled LDA Topic Model and Descriptive Statistics

Latent Dirichlet Allocation [6] based classification is a powerful tool for analyzing latent topics in documents, but it has all the disadvantages inherent to any unsupervised model. In this experiment, wiki pages were classified by page title and topic modeling tags generated using the Labeled Latent Dirichlet Allocation (LLDA) [7] topic model. In this experiment, a single topic hierarchy and label set was generated by manually analyzing the course curriculum and content of the Wiki pages across all the project groups. LLDA results were used to classify the documents according to the topic hierarchy and descriptive statistics measures like number of pages, amount

of content for different topics were used in assessment of student work. Figure1 shows the topic hierarchy that represents the major types of the documents generated by students over the course. The two main topic categories are team management and software engineering principles.
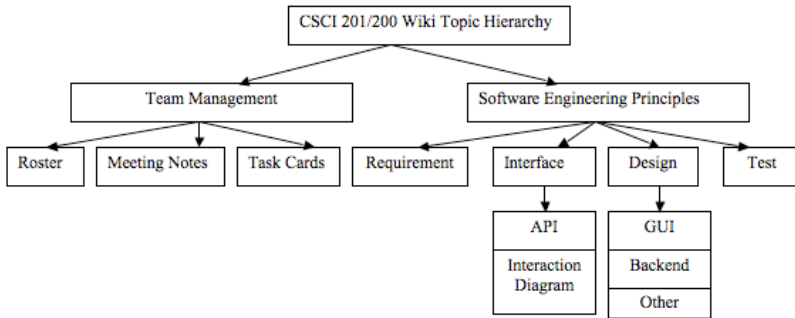

Fig. 1. Topic hierarchy used for the wiki document classification

2.1 Comparison of LLDA and Descriptive Statistics Results

Three randomly drawn teams of students from undergraduate courses working on collaborative programming projects were used in the case study. Table 1 shows the number of documents and content (number of words) in each page classified according to the primary topic. The number of words for each topic category can be used along with the number of pages under that topic category to understand the quality of the group Wiki. Overall, Team1 had the smallest number of documents in Wiki; furthermore they had incomplete backend design and some program topics such as Integration diagram and Test were not found in the Team1 wiki.

Table 1. Number of pages and amount of content (in words) generated by the three teams

Team Name	Wiki									
	Software Engineering Principles						Team Management			
	Interface		Design			Requirement	Test			
	API	Interaction Diagram	Backend	GUI	Other Design	Requirement	Test	Meeting Notes	Roaster	Task Card
Team1	10; 1604	0; 0	2; 100	9; 4047	10; 1495	2; 412	0; 0	8; 534	0; 0	7; 416
Team2	34; 9528	0; 0	14; 9639	14; 2770	8; 12862	6; 1199	1; 26	8; 2690	3; 5091	39; 6302
Team3	3; 883	2; 251	6; 1749	6; 5070	6; 1194	1; 496	0; 0	10; 835	6; 13729	9; 709

2.2 Comparison of Wiki Activity Timeline

The number of updates done by students to each topic category can be benchmarked and low level of activity can be detected to provide immediate feedback to the

instructor and the project group during the course of the project regarding their need to increase level of activity to be at par with other groups. Overall, Team1 got the lowest grade (out of the three teams analyzed); they started early but did not have much activity during the last 4 weeks of the project. Team2 had considerable activity levels for the first 6 weeks. Team3 got the highest score; they started early and worked almost uniformly throughout the course of the project.

Table 2. Timeline of edits to software engineering topic pages for bi-weekly intervals

Timeline in Weeks	Team1	Team2	Team3
10/12/2010 - 10/27/2010	66	90	116
10/28/2010 - 11/11/2010	140	269	56
11/12/2010 - 11/27/2010	3	47	56
11/28/2010 - 12/12/2010	0	4	60

3   Conclusion

The LLDA model based classification with descriptive measures like number of pages, amount of content and timeline of activity can be used to understand productive work patterns and to generate feedback that can help students to stay on track during the course of the project. Future directions would involve improving the accuracy of the labeled LDA model and developing techniques to remove spam or irrelevant content from the wiki.

References

1. Rick, J., Guzdial, M.: Situating CoWeb: a scholarship of application. Computer-Supported Collaborative Learning 1, 89–115 (2006)
2. Ben-Zvi, D.: Using Wiki to Promote Collaborative Learning in Statistics Education. Technology Innovations in Statistics Education 1(1), article 4 (2007)
3. Chen, H.L., Cannon, D.M., Gabrio, J., Leifer, L.: Using Wikis and Weblogs to Support Reflective Learning in an Introductory Engineering Design Course. In: Paper presented at the 2005 American Society for Engineering Education Annual Conference (June 2005)
4. Wang, H.-C., Lu, C.H., Yang, J.-Y., Hu, H.-W., Chious, G.-F., Chiang, Y.-T., Hsu, W.L.: An Empirical Exploration of Using Wiki in an English as a Second Language Course. In: Proceedings of the Fifth IEEE Int'l Conf. on Advanced Learning Technologies (2005)
5. Blei, D.M., Andrew, Y.N., Jordan, M.I.: Latent Dirichlet Allocation. Journal of Machine Learning Research 3, 993–1022 (2003)
6. Ramage, D., Hall, D., Nallapati, R., Manning, C.: Labeled LDA: A supervised topic model for credit attribution in multi-labeled corpora. In: Proceedings of the Empirical Methods in Natural Language Processing Conference (2009)