The Fourth Man – Supporting Self-Organizing Group Formation in Learning Communities

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Abstract: In this paper we propose an approach based on social network analysis facilitated by ontologies for the support of learning group formation in computer supported collaborative and blended learning scenarios. This approach allows us to generate new ties between learners who are interested in similar topics. The identification of similar topics is elaborated dynamically by using a shared workspace environment which supports visual editing and modeling of topic relationships.

Introduction

In recent years blended learning is getting more and more important in the day-by-day teaching and learning at Universities, in further education and even at schools. Course materials are available online as well as the exercises, and the students are expected to work on the particular topic in a self-responsible manner. Many learning scenarios and courses try to combine collaborative and blended learning (e.g. Harrer et al. 2005) – especially in the online phase of the blended learning setting. While even for strict presence learning scenarios the choice of the most adequate group formation mechanism to achieve the learning goal at hand may be a problem, although learners and teachers know each other, e.g. in classroom scenarios, the online phase often adds the problem of not being aware of each other. In a classroom it is obvious if a student has not found a group to work with, because he or she will not be sitting at a group desk. In an online scenario the natural overview on the group formation is reduced and at most visible to the teacher, since persons not assigned to a group should not be exposed to the whole learning community. Although the teacher may be able to intervene in such a group formation situation, we think it would be better to help the students themselves to solve the group formation problem since the self-organization of the students is often a sub goal of the collaborative task.

Systems that explicitly target group formation (Ikeda et al., 1997; Mühlenbrock, 2005) usually require information about user profiles. These are usually domain specific and not easily transferable. On the other hand software products or web-based education installations usually provide one or more communication channels enabling the students to discuss with each other. One of the analysis approaches for such communication is Social Network Analysis (SNA; Wasserman & Faust 1994). It has pointed out the impact of group structure for the learning processes and outcomes (Reffay & Chanier, 2003; Harrer et al. 2005; Martínez et al. 2006). This kind of awareness about group structure is the first step to recommendations addressing group formations. Currently known approaches usually do not support the explicit recommendation of learning partners while protecting the privacy of the students to avoid open social conflicts at the same time. In this paper we propose an approach (Malzahn et al., 2005) based on SNA and facilitated by ontologies (Gruber, 1992) for the support of learning group formation in computer supported collaborative (distance) learning scenarios. In the next sections we will sketch the approach and provide an example for the formation of such a group in a University course with more than 100 students which had to form groups for a software project. The paper closes with a conclusion based on the experiences made so far and the description of further scenarios.

The Approach

Web portals and discussion forums are currently a main source for communication and exchange of expertise both in academia and communities of practice. Popular forums like phpBB2 or FLE3 can be divided into categories to structure these threads. These categories are built of more or less broad topics. If the forum is large, i.e. concerning the amount of writers and categories, most persons know only a subgroup of persons directly involved in topics where they write themselves. Other persons might be interesting to get to know because they share similar interests or they are known as experts in other parts of the forum. In the case that a forum consists of subgroups which do not know or do not communicate with each other except through a small number of persons belonging to both groups, traditional social network analysis will fail to identify the important persons to get to know. Thus persons behind these cut points (Wasserman & Faust, 1994) will be invisible to the investigating person. This is even more emphasized when there are no boundary spanners, i.e. if the communities have no overlapping members. It is easily conceivable that persons who have similar interests participate in different parts of a large forum without having any direct or indirect connection in a communication-network. To be able to find a link between those

persons an additional network-structure must be used. We propose that ontologies should be used to add missing links between persons who should be aware of each other. How this combination of a social network and an ontology is done can be found in Malzahn et al., 2005.

Example: Searching for „The Fourth Man"

Our approach was tested for validity in the context of a university course about „Software Engineering" for undergraduate students of computer science. The course was organized as a blended learning scenario with presence lectures and exercises and extensive online materials manifested in a web portal with discussion forums, wiki etc. Carrying out a software project in groups of 3-5 students was required to pass the course (Harrer et al., 2005). The group formation was handed to the students themselves so that they had to self-organize the composition of the team. Some of the users used the discussion forum to find partners for completing their team. Interestingly this resulted in 3 fragmented threads (s. fig. 2 left) that were all about the search for „The Fourth Man" of the team, but that were not connected with each other directly by joint discussants. They were not even organized in the same forum area. Our approach enables the user to connect the three threads related to students seeking project partners conceptually by creating an ontological relation. This can either be done by e.g. a teacher looking at the threads' topics or by an intelligent agent applying machine learning techniques such as text clustering. The algorithm combining the social network and the ontology produces a network where the students interested in the same topic are visible to each other across the thread's boundaries.
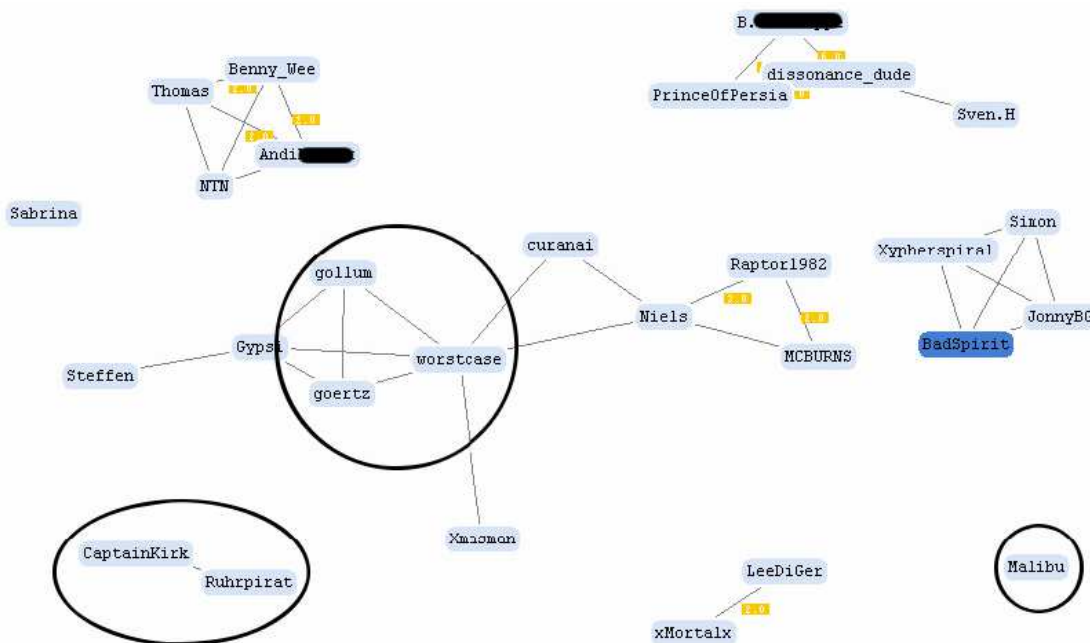

Figure 1. Original Network – Groups searching for the fourth man are highlighted

The original network (cf. fig. 1.) shows 3 groups, searching for additional members. For example the student using the nickname Malibu (fig. 1, lower right) posted once, asking for a fourth person to join his group but received no answer. So he was displayed as an isolated node in the original network. After linking the related topics he is now included in a bigger network. The network on the right of figure 2 shows only the differences between the original network and the resulting one focusing those students with a similar problem as Malibu. In previous courses we had to support this matchmaking manually, while the proposed mechanism makes it possible to support self-organization of the students and contribute to their own responsible acting. The smaller network on the left of figure 2 shows the "ontology" used to establish the relations between Malibu and the other students. The design of this network is an important step to the success of the proposed approach. As stated above the relations can be either set by a software agent relieving the teacher from this work especially in lectures with a high number of students or they can be facilitated by the teachers. This allows them to influence the group formation process as needed to reach the particular learning targets.
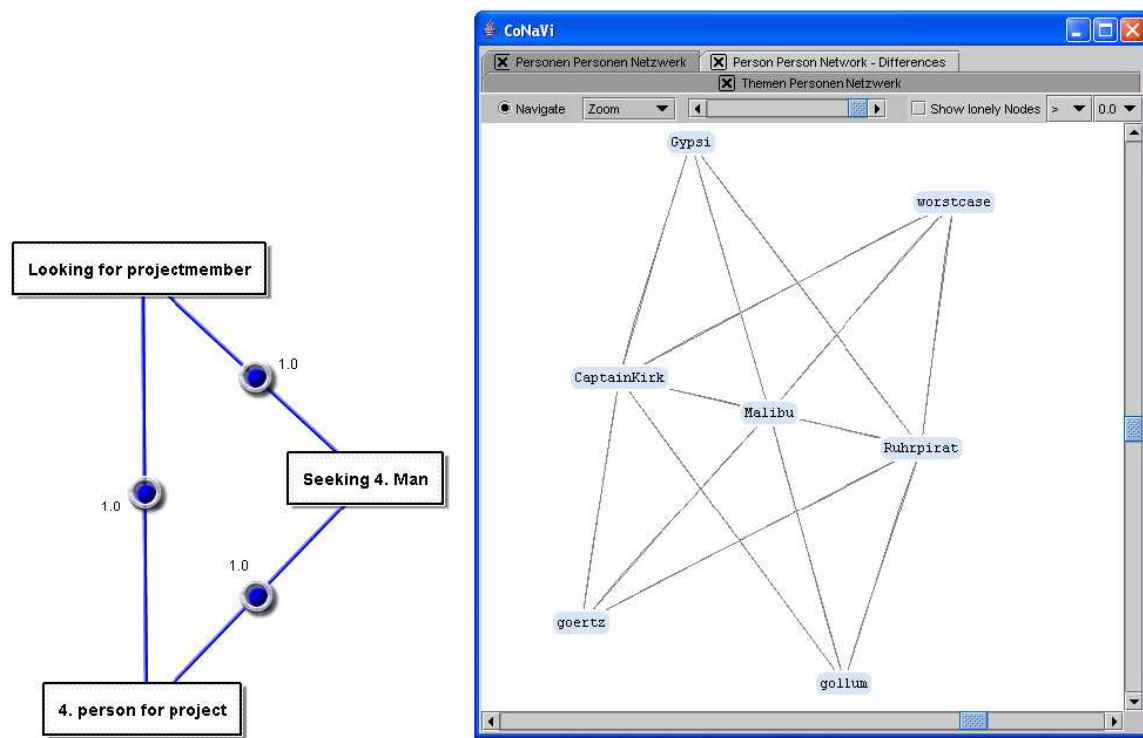
Figure 2. Emerging Relationships

Perspective and Conclusions

In this paper we showed how a collaborative blended learning scenario can be supported by the means of ontology facilitated social network analysis. We discussed how the teacher can create the relations between the forum topics to stimulate the group formation process. Another promising option might be to enable the students themselves in certain scenarios to relate the topics to each other to get a recommendation for partners in the collaborative scenario. This may have two effects: the students have to structure the domain of the task at hand, which might be a learning target in itself, and the students get a feedback of their own position in the group without touching the privacy of the others, because they will only get the information of their personal network. Looking onto the promising results with forums we expect that the concept of integration of ontologies into social networks can be extended to shared information spaces on a general level. This can be done by generalizing the concept of forum topics to learning process artifacts. Artifacts are used in different domains like learning environments (as Learning Object). Thus the same algorithm enables users of complex learning environments to
reflect their position within the particular network.

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