Evolution and Dynamics of Student Interaction on Networks of Face-to-Face Proximity

(Extended Abstract)

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1 Introduction

Analyzing the evolution and dynamics of social interaction networks is important for understanding structure and behavior modeled in such networks, e. g., [1, 5, 21, 26]. Typically, such networks are captured using questionaires, e. g., [33]. In contrast, this paper summarizes an analysis of social interactions on networks of face-to-face proximity complemented by subjective interaction data in the context of a students' freshman week, cf. [32]. The analysis is based on the social distributional hypothesis [25] stating that users with similar interaction characteristics tend to be semantically related. We investigate the communication structure, behavior, and evolution, and the relation of objective and subjective data in the context of social interaction networks [1].

In particular, we examined an introductory week of freshman students that is usually organized as a special course before the regular courses start. The introductory week aims to provide the new students with relevant information about the university, the degree program, and its contents, and includes lectures, as well as discussions, and networking opportunities.

The RFID deployment at the freshman week utilized a variant of the MyGroup [3, 4] system for data collection – an ubiquitous social system for supporting interactions of working groups. Participants volunteered to wear active RFID proximity tags, which can sense and log the close-range face-to-face proximity of individuals wearing them. During the freshman week, participants then integrated the RFID tags into their name tags.

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2 Experiments and Results

Participants volunteered to wear the active RFID proximity tags developed by the SocioPatterns consortium[3]. These proximity tags can sense and log the close-range face-to-face proximity of individuals wearing them. This allows us to map out time-resolved networks of face-to-face contacts among the attendees. A proximity tag sends out two types of radio packets: Proximity-sensing signals and tracking signals. Proximity radio packets are emitted at very low power and their exchange between two devices is used as a proxy for the close-range proximity of the individuals wearing them. Packet exchange is only possible when the devices are in close enough contact to each other (1-1.5 meters). The human body acts as an RF shield at the carrier frequency used for communication [14].

The structure of the freshman week included organized plenary sessions and 'free sessions'. The first day consisted of a general introduction (plenary) and a special introductory (free) session helping students to get to know each other. In the following days, plenary sessions mixed with 'free sessions' took place. Figure 1 provides an overview on the contact activity during the freshman week in order to indicate the activity going on for the different days.

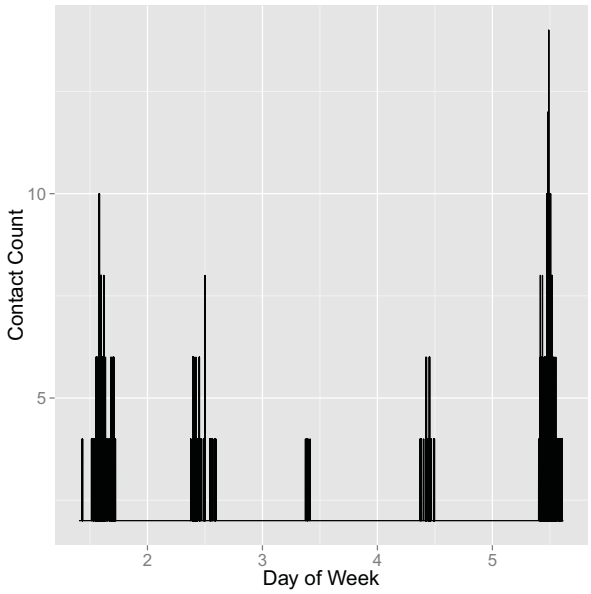

Fig. 1. Overview on the contact behavior: Contact count (per second) during the freshman week.

[3] http://www.sociopatterns.org

In summary, we present results showing that there are distinctive structural patterns in the face-to-face proximity network corresponding to the activities of the freshman week, the communication behavior, and according trends. Furthermore, we focus on the analysis of the captured communication dynamics. Specifically, we investigate the evolution of contacts, as well as the individual connectivity and densification of the network according to the phases of the event. Our results indicate a correlation between the objective interaction network and various subjective networks, extending the analysis results that we presented in [32].

For supporting introductory courses, these results points out the importance of stronger ties (long conversations) between the students at the very beginning of their studies in order to enable an easier start, better cooperativeness and increased support between the students. Also, objective and subjective tend to complement each other with respect to various aspects; therefore, complementary analysis is recommended, cf. [32].

3 Future Work

For future work, we aim at exploring more of the subjective data, in order to capture the behavior of triadic structures in the network, e. g., [28, 29], and to investigate, if subjective information can be predicted given the objective data and vice versa. For that, interesting options also include learning models for predicting the respective contexts.

Here, promising directions in that respect are given by extending and adapting methods for community detection and evolution (e. g., [6, 9, 17, 18, 24]), link prediction (e. g., [15,20,27,29]) and subgroup discovery (e. g., [2,8,12,19,34]). As a basis for the extension of such methods, the VIKAMINE system [7, 10] provides a versatile framework for implementing those methods. Therefore, we aim to perform explorative subgroup analytics, also concerning the research questions sketched below. Then, using subgroups or communities that are "linked" concerning their respective characteristics we can, e. g., utilize predictions concerning contacts for recommendation, or apply those patterns for generating explanations, e. g., [11, 13]. Further promising directions include the analysis of supplementing networks, e. g., co-location networks enabled by localization information [30, 31].

Furthermore, we aim to investigate theory-based approaches in this context. This includes the examination of the paradigms of homophily [23] and incuded homophily [16, 22], e. g., if people that interact much are likely to become more similar over time. We are also interested in the salience shift of homophily characteristics in that context, that is, we aim to investigate processes of categorizing people into a specific ingroup and a set of outgroups based on salient characteristics of the participants; these might change from those that seem obvious on first glance, for example, considering gender, age and ethnicity to more deeper characteristics such as personality traits, values, or interests.

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