

Using Network Science in Learning Analytics: Building Bridges towards a Common Agenda

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Abstract

Interest in using networks in the analysis of digital data has long existed in learning analytics (LA). Applications of network science in our field are diverse. Some researchers analyze social settings in online discussions, knowledge building software, and group formation tools. Others use networked techniques to capture epistemic and cognitive processes. Networked approaches have been pioneered for psychometrics, for the analysis of time-series data, and for various types of clustering of relational observations. Finally, modelling of variables where networks are used as representations of causal relations is also gaining traction. Given the diversity of the thematic foci that researchers engage in when applying network science to learning analytics, this workshop aims to identify common challenges experienced through the use of network science methodologies. The workshop will invite researchers working in the area to share their work and reflect on common challenges. We envision themes of causality, linkage between micro- and macro-processes, use of time and space, elements of generalizability and validity to surface in the group discussions. The workshop aims to gather LA scholars to collectively build a solid foundation of advanced network modeling of learning data and shape strategies of future work in this important sub-field of LA.

Keywords

learning analytics, network science, common challenges

1. Workshop Background

Social network analysis and its sister area of network science is widely used in learning analytics (LA). When positioned within a broader context, LA's focus on quantification of social interactions using digital data is not surprising. Early 2000s were characterized by the wider adoption of the web 2.0 in educational technology, and distance education pedagogies where these technologies were used, have always emphasized learner-to-learner interactions. Moreover, higher education literature referred to the outcomes of social interactions, such as social capital and the sense of belonging, as essential for student retention [1]. In K-12 schools, network analysis has been used to examine racial segregation in schools and further seek ways to support academic success of students from disadvantaged community [2,3]. As a result, analyzing networks has been applied in a range of contexts: university online courses, MOOCs, social text- and video-annotation scenarios, as well as informal learning settings [4]. Capturing learner interactions as network representations also potentially could be used for reflection and visualization of social dynamics in online course forums in LA dashboards.

Examples of empirical work analyzing social dynamics in socio-technical networks are diverse, including identification of network structures in different technological and pedagogical contexts; inquiry into the relationship of individual SNA metrics with performance and learning-related outcomes; clustering learners based on relational activities; examining learner positioning in relation to

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other indicators; detection of learner communities; modelling processes generating online learner networks; demonstrating group-level epistemic views, among others. However, analysis of social dynamics in socio-technical environments is not the only area of application for network science in learning analytics. As sophistication of computational approaches and collected data grew, so did the use of networks' scientific methodologies. The problems that can be studied using a network lens are as diverse as the contexts where they are applied, and far from uniform. Recent adoption of epistemic network analysis and growth of mixed methods in networked methods in one of the EARLI SIGs is just one example. Researchers in NetSci community also use network-related methods to model individual cognition, mental scheme networks, and language networks using common lexicon [5]. These network techniques broadly capture epistemic and cognitive processes for collective and individual systems, groups and individuals. Networked approaches have recently been adopted for the analysis of fine-grained time series data, and pioneered in psychometrics, as models combining various variables contributing to individual states [6]. Finally, modelling of variables, using networks as representations of causal models is also gaining traction.

Given the diversity of thematic foci that researchers engage in when applying network science to learning analytics, this workshop aims to help researchers identify common challenges in their work, through the use of network science methodologies. The workshop will invite researchers working in the area to both share their work and reflect on common challenges. We envision themes of causality, linkage between micro- and macro-processes, use of time and space, as well as elements of generalizability and validity to surface in the group discussions. We envision this conversation to broadly evolve around best practices for operationalization of models that apply network scientific techniques and common research questions that fundamentally build on the complexity science approaches to modelling various systems (e.g. individual cognition, group cognition, epistemic structure, system dynamics, etc.).

2. Workshop Objectives

The workshop objectives are three-fold: to explore the application of advanced network analysis and modeling to learning data; to engage in discussion around the use of network science; and to identify common pain points that we collectively can work on. We hope to identify common areas that need improvement (framework for reporting results in network studies) that can align research efforts. This is a researcher-oriented community-building workshop; the underlying goal is to enable space for researchers using network science to share and engage with one another, as a sub-community leading the development of this area. Submissions for the workshop will include short empirical papers, conceptual papers, and work-in-progress. They will be peer-reviewed.

3. References

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