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SPECIAL ISSUE

Introduction to the special issue on COMPLEX NETWORKS 2018

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We are extremely pleased to present this special issue of *Network Science* which contains a collection of extended papers from the Seventh International Conference on Complex Networks & their Applications (COMPLEX NETWORKS 2018). Initiated in 2011, the conference series has grown to become one of the major international events in network science. Every year, it brings together researchers from a wide variety of scientific backgrounds ranging from finance and economics, medicine and neuroscience, biology and earth sciences, sociology and political science, computer science, physics, and many others in order to review the current state of the field and formulate new directions. The great diversity of the participants allows for cross-fertilization between fundamental issues and innovative applications.

COMPLEX NETWORKS 2018 was hosted at the Department of Computer Science and Technology of the University of Cambridge (UK)—a true place of innovation—from December 11 to December 13, 2018. It attracted 421 submissions originating from more than 50 countries around the world. After a rigorous reviewing process, the conference program committee selected 123 papers to be published in the conference proceedings (Aiello et al., 2018a,b). The conference program also included keynote presentations from Vittoria Colizza (INSERM, France), Aristides Gionis (Aalto University, Finland), Sune Lehmann (Technical University of Denmark, Denmark), Hernan Makse (City College of New York, USA), Romualdo Pastor-Satorras (Universitat Politcnica de Catalunya, Spain), Donald Towsley (UMass Amherst, USA), and tutorials delivered by Jess Gmez-Gardees (University of Zaragoza, Spain) and Silvio Lattanzi (Google Zurich, Switzerland).

The papers invited for this special issue have been selected from the accepted contributions based on the relevance to the journal and the reviews of the conference version of the papers. The authors were asked to submit an extended version of their conference submission for journal publication in accordance with the customary practice of adding 30% new material. These submissions went through a double-blind review process in accordance with the journal guidelines. The seven papers forming this special issue provide a remarkable sample illustrating the diversity of issues in complex networks research.

Hoffman et al. (2020) introduce a new model of the dynamics of face-to-face interactions in social groups. Although recent advances in sensor technologies provide new opportunities to measure the composition and evolution of face-to-face interactions (Elmer et al., 2019), the group nature of such interactions is rarely taken into account. Addressing this gap allows multiple advances in the analysis of numerous situations such as the dynamics of children groups at school, the communication structure of an organization, or the emergence of new social groups at social gatherings or conferences.

Interdonato et al. (2020) propose an unsupervised technique to extract a multilayer network from satellite image time series. An application to the land use issue based on a community detection approach is presented in order to assess the potential of this technique. In recent years,

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network science has been successfully applied in image and video processing (Mourchid et al., 2019*b*,a), but applications in the remote sensing domain have not so far been developed. This pioneering work paves the way for multiple land monitoring tasks, such as fire mapping, forest and agricultural monitoring, and climate change analysis.

Arora et al. (2020) consider the issue of quantifying the ability of network models to replicate characteristics of a population of networks. Indeed, using a single network to explore generative mechanisms does not account for the natural variability of the population from which it is sampled. While there are numerous methods to compare pairs of networks (Emmert-Streib et al., 2016; Bagrow & Bollt, 2019), comparing network populations is still a relatively unexplored area. The authors show that it is possible to establish a baseline test set to evaluate the ability of a network model to capture the distribution of network populations. Their study highlights the need to develop models that are able to extract and quantify the variability existing in network populations.

Tabassum et al. (2020) proposed an algorithm for predicting recurring links in evolving weighted multigraph. While previous works mainly rely on proximity measures or structural heuristics that are computationally expensive for massive graph streams (Marjan et al., 2018), this dynamic sampling-based method predicts recurring links without exploiting the time and space expensive neighborhood for each node/link, or global information of the network. Experiments with massive real-world graph streams demonstrate the effectiveness of the proposed method. This algorithm has numerous applications in real-world scenarios such as purchases and mobility settings where recurring links are a significant fraction of total network links.

In Treur (2019), the relation between structure and asymptotic behavior of a network is addressed. Previous results have been restricted to the case of acyclic, fully connected or strongly connected networks (Treur, 2018). In this paper, general theorems that go beyond these hypotheses relating asymptotic network behavior to the network characteristics are given. Relevant features such as combination functions used to aggregate the effects of multiple incoming connections (in particular, monotonicity, scale-freeness, and normalization) are discussed.

In Treur (2020), a multilevel network architecture accounting for network adaptation is introduced. This architecture allows us to distinguish the dynamics within the network at the base level from the dynamics of the network itself via certain adaptation principles (first-order adaptation level) and the adaptation of these adaptation principles (second-order adaptation level). The general framework is illustrated by an adaptive adaptation principle from social science for bonding based on homophily.

In Cann et al. (2020), various projection schemes of bipartite networks in a community detection setting are investigated. Indeed, although community detection of bipartite networks can be performed using unipartite methods, projection-based methods are more effective (Arthur, 2020). Unipartite projections are taken using seven different edge-weighting schemes, before testing the ability of unipartite community detection algorithms to recover bipartite community structure. Synthetic networks with known community structure as well as a real-world dataset from social media are used in the experiments. Results allow the researchers to give strong recommendations about the effectiveness of the seven projection methods under study.

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Conflict of interest. The authors have no conflict of interest to declare.

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