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Guest Editorial

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Modeling and analyzing networks is a major emerging topic in different research areas, such as computational biology, social science, document retrieval and social web applications. By connecting objects, it is possible to obtain an intuitive and global view of the relationships among components of a complex system.

Nowadays, scientific communities have access to huge volume of network-structured data, such as social networks, gene/proteins/metabolic networks, sensor networks, and peer-to-peer networks. Often, data is collected at different time points allowing capturing a dynamic trend of the observed network. Consequently, the time component plays a key role in the comprehension of the evolutionary behavior of the studied network (evolution of the network structure and/or of flows within the system). Time can help to determine the real causal relationships within, for instance, gene activations, link creation, and information flow. Handling such data is a major challenge for current research in machine learning and data mining, and it has led to the development of recent innovative techniques that consider complex/multi-level networks, time-evolving graphs, heterogeneous information (nodes and links), and requires scalable algorithms that are able to manage large-scale complex networks.

This special issue is the follow-up of the Dynamic Networks and Knowledge Discovery workshop (DyNaK)[1] that has been held in conjunction to ECML-PKDD 2011 at Barcelona on September 24th 2011. The workshop was motivated by the interest of providing a meeting point for scientists with different backgrounds who are interested in the study of large-scale dynamic complex networks. The workshop has attracted 18 submissions out of which 9 papers has been accepted. The workshop has gathered more than 30 participants and was also the host of three highly appreciated invited keynotes and one industrial talk.

Building on the success of the DyNaK workshop, an open call for papers has been issued for this special issue, focusing on the major topic discussed in the workshop: analyzing, modeling and mining large-scale real network. 15 high quality papers have been received; each of which has been reviewed by three reviewers. Only 7 contributions were finally selected. These contributions show the vitality of the field: a broad panel of techniques are applied to modeling the dynamics of complex systems, using a wide set of formalisms ranging from descriptive rules to Probabilistic Real-Time Automata. Application fields are also wide: vision, opinion diffusion in social network, business process modeling and text mining.

In *Internal link prediction: a new approach for predicting links in bipartite graphs*, Allali et al. present an algorithm for predicting internal link in bipartite graph. They address the problem of predicting

[1]http://kdd.di.unito.it/DyNaK2010/.

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links in a collaborative filtering framework without bypassing the natural bipartite nature of this kind of graphs.

In the article *Evolving Networks: Eras and Turning Points*, Berlingerio et al. present an original evolutionary clustering approach for analyzing the temporal evolution of network and detecting the so-called turning points of the eras. They apply their methodology to three typologies of evolving graphs: a co-authorship network, a collaboration graph and a terrorist network.

The article *Discovering Descriptive Rules in Relational Dynamic Graphs* by Nguien et al. introduces an extension of the well-known association rules mining task for Boolean tensor data. In this new formulation, association rules may involve subsets of any dimension on both their antecedent and consequent parts. This involves also the definition of new interestingness measures.

In *Mining Spatiotemporal Patterns in Dynamic Plane Graphs*, Prado et al. propose two algorithms for extracting spatiotemporal patterns from dynamic networks that can be represented as plane graphs. These algorithms are applied in a video-tracking framework, where videos are considered as series of plane graphs.

The article *Learning Probabilistic Real-Time Automata from Multi-Attribute Event Logs* by Schmidt et al. present a new method for learning process models in the form of Probabilistic Real-Time Automata for multi-attribute event logs. They apply their approach to biological and medical data successfully.

In *Story Graphs: Tracking document set evolution using dynamic graphs*, Subasic and Berendt show how to track stories on the web by analyzing the dynamics of word-association graphs, as representations of the documents.

Finally, in the article *Towards Combating Rumors in Social Networks: Models & Metrics*, Tripathy et al. study several mathematical models for countering the rumors that spread in social media like Twitter. Their basic assumption is that rumors should be fought using messages, called anti-rumors, that spread in the network exploiting its mathematical properties.

We would like to warmly thank: the ECML-PKDD 2011 team for making it possible to organize the DyNak workshop and Fazel Famili, who was a very kind and efficient partner in all the steps of elaborating this special issue; authors, for the quality of their submissions; all the reviewers without whom this special issue would not have been possible.

We hope that you like our special issue!

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