

## Editorial

# Emerging Applications of Complex Networks

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A large amount of research is available on complex networks modeling and simulation, with applications to smart grids and energy, vehicular traffic, diseases and epidemics, ecosystems, supply chains, financial systems, social science, urban environment, and so on. However, there are still some topics where complex networks are just starting to pursue their role.

With new hybrid mathematical modeling tools and the power of computation, there is a broad range of emerging applications. Thus novel research focuses on these topics, like arts and literature, human senses, medicine and physiology, psychology, lifestyle, philosophy, and project management.

This special issue holds 6 original research articles and various applications regarding products, voting, arts, project management, language, and safety as emergent applications of Complex Networks.

**Z. Sha et al.** showed how understanding customer preferences in consideration decisions is critical to choice modeling in engineering design. In their paper, they presented a network-based approach based on Exponential Random Graph Models to study customers' consideration behaviors according to engineering design. Their approach is capable of modeling the endogenous effects among products through various network structures (e.g., stars and triangles) besides the exogenous effects and predicting whether two products would be considered together. Using buyer survey data from the China automarket in 2013 and 2014, they evaluate the goodness of fit and the predictive power of the two models.

**J. Fernández-Gracia and L. Lacasa** present a social network and forensic analysis of the vote counts of Spanish national elections that took place in December 2015 and their

sequel in June 2016. They initially consider the phenomenon of bipartisanship breakdown and find that such breakdown is more prominently close to cosmopolite and largely populated areas and less important in rural areas. Through functional network analysis they detect an effective partition of municipalities which remarkably coincides with the first-level political and administrative division of autonomous communities. Finally, they further explore the cooccurring statistics of vote share and turnout, finding a mild tendency in the clusters of the conservative party to smear out towards the area of high turnout and vote share, what has been previously interpreted as a possible sign of incremental fraud.

**E. Estrada and P. Pereira-Ramos** produced a relevant and very interesting and original document on deconstructivism, as an aesthetically appealing architectonic style. They identify some general characteristics of this style, such as decomposition of the whole into parts, superposition of layers, and conservation of the memory of the whole. Using these attributes, they propose a method to deconstruct functions based on integers and generate spatial networks which display a few artistic attributes such as (i) biomorphic shapes, (ii) symmetry, and (iii) beauty. They show how these networks inspire an artist to create artistic compositions using mixed techniques on canvas and on paper. They specially claim that the aesthetic of network research, and not only its applicability, would be an attractor for new minds to this field.

**L. S. Cardona-Meza and G. Olivar-Tost** discuss about project management, which is predominantly based on theories of control. In complex environments, management problems arise from assuming that results, predicted at the

start of a project, can be sufficiently described and delivered as planned. Thus, once a project reaches a critical size, a calendar, and a certain level of ambiguity and interconnection, the analysis centered on control does not function adequately. In their study, through a complex network, the dynamic structure of a project and its trajectories are simulated using inference processes. Finally, some numerical simulations are described, leading to a decision making tool that identifies critical processes, thereby obtaining better performance outcomes of projects.

**V. A. Gromov and A. M. Migrina** produced a paper on natural language (represented by texts generated by native speakers). It is considered as a complex system, and the type thereof to which natural languages belong is ascertained. The authors hypothesize that a language is a self-organized critical system and that the texts of a language are “avalanches” flowing down its word cooccurrence graph. The respective statistical characteristics for distributions of the number of words in the texts of English and Russian languages are calculated. The analysis found that the number of words in the texts obeys power-law distribution.

**Y. Deng et al.** showed that capturing the interrelations among risks is essential to thoroughly understand and promote coal mining safety. Several parameters were employed to reveal the topological properties of the network. As indicated by the results, the considered network possesses scale-free network property because its cumulative degree distribution obeys power-law distribution. This means that it is robust to random hazard and vulnerable to deliberate attack. Also, it is a small-world network due to its relatively small average path length as well as high clustering coefficient, implying that accident propagation in this type of network is faster than in regular ones. Furthermore, the effect of risk control is explored. According to the result, it shows that roof collapse, fire, and gas concentration exceeding limit refer to three most valuable targets for risk control among all the risks.

In summary, this special issue will provide a nice panorama of the present status of emerging applications and recent developments, giving novel and important insights of management, physical, and art applications.

## Conflicts of Interest

The editors declare that there are no conflicts of interest regarding the publication of this editorial.

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