



## OPEN ACCESS

EDITED AND REVIEWED BY

Maxi San Miguel,  
IFISC (CSIC-UIB), Spain

\*CORRESPONDENCE

Claudio Castellano,  
✉ claudio.castellano@roma1.infn.it

RECEIVED 29 March 2024

ACCEPTED 02 April 2024

PUBLISHED 17 April 2024

CITATION

Castellano C and Preciado VM (2024), Editorial:  
Insights in complex networks.  
*Front. Complex Syst.* 2:1409101.  
doi: 10.3389/fcpxs.2024.1409101

COPYRIGHT

© 2024 Castellano and Preciado. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

# Editorial: Insights in complex networks

Claudio Castellano<sup>1\*</sup> and Victor M. Preciado<sup>2</sup><sup>1</sup>Istituto Dei Sistemi Complessi (ISC-CNR), Rome, Italy, <sup>2</sup>University of Pennsylvania, Philadelphia, PA, United States

KEYWORDS

networks, complex systems (CS), multilayer, coevolution, communities

## Editorial on the Research Topic Insights in complex networks

The special issue “*Insights In Complex Networks*” in the new journal *Frontiers in Complex Systems* gathers a collection of research contributions covering a wide range of problems in the exciting research field of Complex Networks. The contributions in this issue cover some of the most relevant questions in the current state of this field: spreading on real topologies; higher-order and multilayer structures; coevolution of networks and topology; mesoscopic structures.

The first paper on this special issue, titled “*Crisis Spreading in Multinational Firms’ Network: the dual influence of local interactions*” provides an analysis of the implications of local interactions within global networks. In this work, [Tsouchnika et al.](#) explain how intra-urban interactions within the network of multinational firms interactions can both promote or mitigate the propagation of economic crises. This line of work is of great relevance, since the resilience of the global economic network is constantly being tested by new and unexpected shocks. By mapping the dual influences of intra-urban connections, the paper introduces an insightful model for understanding the dynamics of crisis spread and containment. It remarks the need for strategic planning and the potential for localized interventions to influence global behaviors, offering a benchmark for future research aimed at enhancing the stability of economic systems.

The second paper, “*Topology and Spectral Interconnectivities of Higher-Order Multilayer Networks*” by [Moutuou et al.](#), introduces the concept of crosssimplicial multicomplexes as a flexible framework for representing interdependent systems with higher-order connections. The authors also introduce the concepts of cross-homology and cross-Laplacian operators, which provide the mathematical tools to quantify global and local intra- and inter-layer topological structures. Using synthetic and empirical datasets, the authors show that the spectra of the cross-Laplacians of a multilayer network detect different types of clusters in one layer that are controlled by hubs in another layer. The flexibility of the proposed framework allows it to be used to study structural and functional connectomes combining connectivities of different types and orders.

The third paper, “*Coevolutionary Dynamics of Group Interactions*” by [Min](#), surveys the coevolutionary dynamics of network topology and opinion formation. The author proposes a nonlinear voter model that incorporates two disparate mechanisms: a nonlinear group interaction in the voter model, as well as a mechanism of network plasticity able to rewire and remove links between individuals with different opinions. The role of group interactions is then analyzed and, it is concluded by the author that the nonlinearity in the model can significantly impact the dynamics of the states and the network topology.

Last, but not least, the paper “*The Projection Method: A Unified Formalism for Community Detection*” by [Gosgens et al.](#), presents a class of projection methods able to generalize several

popular algorithms for community detection in networks. This method represents each partition by a high-dimensional vector in a hypersphere and follows a two-step approach to find communities. The authors also address the nontrivial problem of choosing a granularity level and provide a heuristic method to address it.

The papers in this special issue are examples of the interdisciplinary collaboration required for analyzing some of the most relevant research questions in the field of complex networks. We invite researchers and students in this field to engage with these contributions, reflect on the challenges and opportunities they present, and contribute to the ongoing conversation on the future of complex networks research.

## Author contributions

CC: Writing—original draft, Writing—review and editing. VP: Writing—original draft, Writing—review and editing.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

## Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.