

## **SORS: "Multilayer modeling and analysis of complex biological systems"**

### **Abstract**

Complex systems are characterized by constituents -- from neurons in the brain to individuals in a social network -- which exhibit special structural organization and nonlinear dynamics. As a consequence, a complex system can not be understood by studying its units separately because their interactions lead to unexpected emerging phenomena, from collective behavior to phase transitions.

In the last decade, we have discovered that a new level of complexity characterizes a variety of natural and artificial systems, either where homogeneous units simultaneously interact in distinct ways or where interdependency between heterogeneous units or sub-systems emerge. The unprecedented newfound wealth of data allows to characterize such systems by defining distinct "layers", each one encoding a different network representation of the system. The result is a multilayer network model.

In this talk we will introduce the most salient features of multilayer systems in terms of their structural representation and dynamical processes, and discuss some practical applications to biological networks of interest for systems biology and systems medicine, while discussing opportunities and limitations affecting network reconstruction and analysis in general.



### **Short Bio**

De Domenico is Associate Professor of Physics at the Department of Physics and Astronomy "Galileo Galilei", University of Padua (Italy) where he also directs the Complex Multilayer Networks Lab. He is a member of the Scientific Board of the Padua Neuroscience Center and Program Director of the Padua Center for Network Medicine. He is the national coordinator of the Italian Chapter of the Complex Systems Society and founding Director of the Mediterranean School of Complex Networks.

De Domenico is interested in a variety of complex systems, with works from human mobility and infectious disease spreading, to protein-protein interactions and connectomics. His research focuses on collective phenomena emerging from natural and artificial interdependent systems, with contributions to multiscale modeling and analysis of multilayer networks, their structure, dynamics, information capacity and resilience to shocks, finding applications in systems biology, systems medicine and computational epidemiology.

For his work he received the Young Scientist Award for Socio- and Econophysics from the German Physical Society (2020), the IUPAP Young Scientist Award on Statistical Physics from the IUPAP-C3 (2019), the USERN Prize in Formal Sciences from USERN (2017) and the Junior Scientific Award from the Complex Systems Society (2016).

He has published more than 170 scientific papers on peer-reviewed journals, attracting 21000+ citations (Apr 2024, Google Scholar).

## **Speakers**

**Speaker:** Manlio De Domenico, Associate Professor of Applied Physics at Department of Physics and Astronomy "Galileo Galilei", University of Padua (Italy); Padua Center for Network Medicine, University of Padua (Italy); Padua Neuroscience Center, University of Padua (Italy); INFN Sez. Padua (Italy).

**Host:** Davide Cirillo, Leading researcher, Machine Learning for Biomedical Research, Life Sciences, BSC. Barcelona Supercomputing Center - Centro Nacional de Supercomputación

---

**Source URL (retrieved on 11 ago 2024 - 15:25):** <https://www.bsc.es/ca/research-and-development/research-seminars/sors-multilayer-modeling-and-analysis-complex-biological-systems>