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SPEAKER TITLES/ABSTRACTS

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"Multilayer Modeling and Analysis of Complex (Systems) Data"

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 cannot be understood by studying its units separately because their interactions lead to unexpected emerging phenomena, from collective behavior to phase transitions.
Recently, we have discovered that a new level of complexity characterizes a variety of natural and artificial systems, where units interact, simultaneously, in distinct ways. For instance, this is the case of multimodal transportation systems (e.g., metro, bus and train networks) or of biological molecules, whose interactions might be of different type (e.g. physical, chemical, genetic) or functionality (e.g., regulatory, inhibitory, etc.). The unprecedented newfound wealth of multivariate data allows to categorize system's interdependency by defining distinct "layers", each one encoding a different network representation of the system. The result is a multilayer network model.

Analyzing data from different domains -- including molecular biology, neuroscience, urban transport, telecommunications -- we will show that neglecting or disregarding multivariate information might lead to poor results. Conversely, multilayer models provide a suitable framework for complex data analytics, allowing to quantify the resilience of a system to perturbations (e.g., localized failures or targeted attacks), improving forecasting of spreading processes and accuracy in classification problems.

References

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