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Department of Medicine
Channing Division of Network Medicine

Channing Network Science Seminar

Feb 7 (Tuesday), 2017, 10:30am @ 4th floor conference room



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Beyond interdependent networks: bringing networks of networks to life

Complex networks rarely appear in isolation. From critical infrastructure, to physiology and the human brain, we observe that functionality of nodes in one system promotes or suppresses the functionality of nodes in another. This feature is studied intensively in interdependent percolation where functionality is identified with connectivity, but its application in more realistic, dynamic systems has remained elusive. Here we will discuss two new directions: process-based and dynamic interdependence. In the first, we will see how interdependent percolation can be implemented in a system where the functionality is determined by the existence of flow through a node and not by connectivity alone. Next, we will see how the basic concept of a dependency link can be implemented in a broad class of dynamic systems by linking the coupling of a node in one layer with the local order of a node in another layer. With this approach, competition or more exotic cross-network interactions are straightforward to model. When applied to oscillator networks, we find a wealth of realistic new phenomena including explosive synchronization, hysteresis, multi-stability and chaotic attractors. This simple yet powerful approach opens up a way to model and understand the interacting multi-layer networks which surround us.

Bio: Michael is currently a senior doctoral student in the lab of Prof. Shlomo Havlin at Bar-Ilan University in Israel and an Azrieli Foundation fellow. His doctoral research has focused on bringing network models closer to reality: by developing a new method to modulate and analyze spatial effects on a network topology, studying the effects of failures and attacks that are localized in space, and developing new types of interdependent models that more closely model real-world systems. With collaborators from RBI in Croatia, Michael developed a new network-based approach to cybersecurity called color-avoiding percolation. Since 2013, Michael has given over a dozen invited and contributed talks at conferences and universities in eight countries and he recently received the award for best oral presentation at NetSciX 2017 in Tel Aviv.

Hosted by Yang-Yu Liu