BRIGHAM AND WOMEN'S HOSPITAL
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Department of Medicine
Channing Division of Network Medicine

Channing Network Science Seminar

May 6th (Friday), 2022, 11AM (ET)

Zoom link: https://us02web.zoom.us/j/579497999?pwd=cHNIWHMzWUlFUUVJTG1EeVJmY05aQT09
Meeting ID: 579 497 999
Passcode: 844168

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Reviving a failed network through microscopic interventions

Abstract: From mass extinction to cell death, complex networked systems often exhibit abrupt dynamic transitions between desirable and undesirable states. These transitions are often caused by topological perturbations (such as node or link removal, or decreasing link strengths). The problem is that reversing the topological damage, namely, retrieving lost nodes or links or reinforcing weakened interactions, does not guarantee spontaneous recovery to the desired functional state. Indeed, many of the relevant systems exhibit a hysteresis phenomenon, remaining in the dysfunctional state, despite reconstructing their damaged topology. To address this challenge, we developed a two-step recovery scheme: first, topological reconstruction to the point where the system can be revived and then dynamic interventions to reignite the system's lost functionality. By applying this method to a range of nonlinear network dynamics, we identify the recoverable phase of a complex system, a state in which the system can be reignited by microscopic interventions, for instance, controlling just a single node. Mapping the boundaries of this dynamical phase, we obtain guidelines for our two-step recovery.

Biography: *I graduated with a B.Sc. in Physics & Mathematics from Bar-Ilan University, Israel. Now, I am about to finish my Ph.D. in Physics in the field of network theory under the supervision of Prof. Shlomo Havlin and Prof. Baruch Barzel at Bar-Ilan University, Israel. In my research, I focused on nonlinear dynamics on complex networks, such as gene regulation, neural dynamics, and microbiome dynamics, developing methods for reviving system dynamics through minimal dynamic interventions. It joins my other papers on: percolation on interdependent networks, epidemics on static and evolving networks, cascading overload failures in spatial networks, and random walk and foraging problems.*