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Articulation Points in Complex Networks

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Abstract:

An articulation point in a network is a node whose removal disconnects the network. Those nodes play key roles in ensuring connectivity of many real-world networks, from infrastructure networks to protein interaction networks and terrorist communication networks. Despite their fundamental importance, a general framework of studying articulation points in complex networks is lacking. Here we develop analytical tools to study key issues pertinent to articulation points, such as the expected number of them and the network vulnerability against their removal, in an arbitrary complex network. We find that a greedy articulation point removal process provides us a different perspective on the organizational principles of complex networks. Moreover, this process results in a rich phase diagram with two fundamentally different types of percolation transitions. Our results shed light on the design of more resilient infrastructure networks and the effective destruction of terrorist communication networks.

Biography:

Professor Yang-Yu Liu is currently an Assistant Professor of Medicine at Harvard Medical School (HMS) and an Associate Scientist at Brigham and Women's Hospital (BWH). He received his Ph.D. in Physics from University of Illinois at Urbana-Champaign in 2009, with thesis research focusing on phase transitions in disordered magnets. After that, he held positions as Postdoctoral Research Associate and then Research Assistant Professor at the Center for Complex Network Research at Northeastern University, before he joined HMS and BWH in 2013. The primary goal of his recent research has been to combine tools from control theory, network science and statistical physics to address fundamental questions pertaining to the control of complex networks. His work on controllability and observability of complex networks have been featured as a cover story in *Nature*, a cover story in the *PNAS*, and received broad media coverage including *Nature*, *Science*, *ScienceNews*, *ScienceDaily*, *Wired*, etc. His current research efforts focus on developing multidisciplinary approaches for network medicine and complex diseases. For more information, please visit *http://scholar.harvard.edu/yyl/*