CEU Department of Network and Data Science | CENTRAL EUROPEAN UNIVERSITY

A PERTURBATIVE THEORY OF NETWORK DYNAMICS

A PUBLIC TALK BY

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ABSTRACT | Universal network characteristics, such as the scale-free degree distribution and the small world phenomena, are the bread and butter of network science. But how do we translate such topological findings into an understanding of the system's dynamic behavior: for instance, how does the small world structure impact the patterns of flow in the system? Or how does the presence of hubs affect the distribution of influence? In essence, whether it is communicable diseases, genetic regulation or the spread of failures in an infrastructure network, these questions pertain to the patterns of information spread in the network. It all begins with a local perturbation, such as a sudden disease outbreak or a local power failure, which then propagates to impact all other nodes. The challenge is that the resulting spatio-temporal propagation patterns are diverse and unpredictable - indeed a *Zoo* of spreading patterns - that seem to be only loosely connected to the network topology. We show that we can tame this zoo, by exposing a systematic translation of topological elements into their dynamic outcome - exposing a deep universality behind the seemingly diverse dynamics.

BIO | Baruch Barzel is a physicist and applied mathematician, director of the Complex Network Dynamics lab at Bar-Ilan University. His main research areas are statistical physics, complex systems, nonlinear dynamics, and network science. Barzel completed his Ph.D. in physics at the Hebrew University of Jerusalem, Israel as a Hoffman Fellow. He then pursued his postdoctoral training at the Center for Complex Network Research at Northeastern University and at the Channing Division of Network Medicine, Harvard Medical School. Barzel is also an active public lecturer, presenting a weekly corner on Israel National Radio. Dr. Barzel's research focuses on the dynamic behavior of complex networks, uncovering universal principles that govern the dynamics of diverse systems, such as disease spreading, gene regulatory networks, protein interactions or population dynamics.