

Annotated bibliography on complex networks

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References

- [1] Anna D. Broido and Aaron Clauset. Scale-free networks are rare. pages 26–28, 2018.

A central claim of modern network science is that real-world networks are typically scale-free, meaning that degree distribution follows a power law k^γ with $2 < \gamma < 3$. Authors test this claim with 927 data sets from the Index of Complex Networks (ICON), comparing its plausibility via a likelihood test to alternative models, e.g., log-normal. Results show that only a few fraction of these networks show strong evidence of being scale-free. Authors claim that there is likely no single universal mechanism (e.g., preferential attachment) that can explain the wide diversity of degree structure found in real-world networks.

- [2] Liang Dai, Ben Derudder, and Xingjian Liu. The evolving structure of the Southeast Asian air transport network through the lens of complex networks, 1979–2012. *Journal of Transport Geography*, 68(October 2017):67–77, apr 2018.

The article explores the structural evolution of the Southeast Asian air transport network (SAAN) during 1979-2004 from a complex network perspective. First, authors study the evolution of network metrics (scale-free properties, dissortative mixing and small-world properties), and compare them with other major regional blocs. Second, they unveil the core-bridge-periphery structure of the SANN, and its temporal evolution. This multilayer structure has experienced significant changes in the studied period, as the core of the network shifts towards the north. Additionally, the introduction contains an geographical and historical analysis of Southeast Asia, and discuss the opportunity of defining region boundaries to analyze transportation networks.

- [3] Gueorgi Kossinets and Duncan J Watts. Empirical analysis of an evolving social network. *Science*, 311(5757):88–90, jan 2006.

Authors analyze a social network of e-mail interactions in a population of 43,553 members of a university, retaining 14,584,423 messages exchanged during 355 days of observation. They approximate instantaneous strength of a relationship by the geometric rate of bilateral email exchange within a window of 60 days. The instantaneous network at any point of time includes all pairs of individuals that sent one or more messages in each direction in the last 60 days. Using the later representation, they calculate the shortest path length and the number of shared affiliations for all members during 210 days. Appearance of new ties is assessed with two measures. Cyclic closure bias is the empirical probability that two individuals initiate a new tie as a function of shortest path length. Focal closure bias is the probability that two individuals who share an interaction focus share a new tie. For this network, average network properties appear to approach an equilibrium state, while individual properties are unstable.

- [4] Adilson E. Motter and Ying-Cheng Lai. Cascade-based attacks on complex networks. *Physical Review E*, 66(6):065102, dec 2002.

Authors introduce a model for cascading failures in complex networks, suitable for networks that vehiculate flows of information, energy or physical quantities. In these networks, the load of a node is equal to the total number of shortest paths passing through it (sometimes approximated by node betweenness). The capacity of a node is proportional to its initial load. The failure of a node can lead to a redistribution of loads, that can conversely lead to the failure of nodes in which capacity is exceeded. Authors find that cascading failures occur in networks with a highly heterogeneous distribution of loads (e.g., scale-free networks), when the removed nodes are among those of higher load.

- [5] Shuliang Wang, Liu Hong, Min Ouyang, Jianhua Zhang, and Xueguang Chen. Vulnerability analysis of interdependent infrastructure systems under edge attack strategies. *Safety Science*, 51(1):328–337, jan 2013.

This paper analyzes the vulnerability of a two interdependent networked systems to cascading failures: a power grid and a gas network. The cascading failure model of the power grid is the defined in Wang

et al. (2008), where edge load is proportional to the power of product of edge's nodes. The model for the gas network is the generalized betweenness centrality model defined in Carvalho et al. (2009). Network interdependence is modeled through a specific interdependence function. Nodes that lead to interdependence are detected using spatial proximity criteria. Authors define three categories of network disturbance: random failures, deliberate attacks and natural disasters. Deliberate attacks are defined as suppression of edges of high load and nodes of high degree. The results of the vulnerability metrics are global vulnerability analysis and critical component analysis. Global vulnerability is measured with network efficiency and damaging rate. Critical component analysis reports the network components whose damage would lead to larger vulnerability.