Diachronic Equivalence: An Examination of the International News Network

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Abstract

Barabási (2014) argues that a significant proportion of nodes can be randomly removed from any scale-free network without it breaking apart. Gao, Barzel and Barabási (2016) suggest that three additional properties of networks, density, heterogeneity and symmetry, facilitate their ability to adjust their activities to retain functionality in times of stress. Barnett and Jiang (2016) examined the World Wide Web and found that while there are changes in the use of individual websites in this scale-free network due to weekly cycles in viewing specific websites, extreme events as well as other social and cultural events, the overall network is remarkably stable. This paper suggests an additional property, the structural equivalence of nodes that facilitates network stability. Further, it differentiates between two forms of equivalence, synchronous or structural equivalence, and diachronic equivalence, which indicates that two nodes' position in a network change over time in a similar manner. A subset of the World Wide Web, the international news network is examined to demonstrate these notions. Daily data on the use of the world's 44 most frequently visited news websites by 118 countries were mined over the 17 month period September 1, 2015 to January 30, 2017, to create a longitudinal two-mode network (countries and websites). The results suggest that individual structurally and diachronic equivalent nodes may be removed from both the international and website networks without impacting how the network changes over time.