

Multiplex PageRank

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Many complex systems can be described as multiplex networks in which the same nodes can interact with one another in different layers, thus forming a set of interacting and co-evolving networks. Examples of such multiplex systems are social networks where people are involved in different types of relationships and interact through various forms of communication media. In this talk I will present models for multiplex evolution and formation and I will address the problem of the ranking of nodes in multiplex networks which is one of the most pressing and challenging tasks that research on complex networks is currently facing. When pairs of nodes can be connected through multiple links and in multiple layers, the ranking of nodes should necessarily reflect the importance of nodes in one layer as well as their importance in other interdependent layers. Here, we draw on the idea of biased random walks to define the Multiplex PageRank centrality measure in which the effects of the interplay between networks on the centrality of nodes are directly taken into account. In particular, depending on the intensity of the interaction between layers, we define the Additive, Multiplicative, Combined, and Neutral versions of Multiplex PageRank, and show how each version reflects the extent to which the importance of a node in one layer affects the importance the node can gain in another layer. I will show an application of these ranking measures to an online multiplex social network. Findings indicate that taking the multiplex nature of the network into account helps uncover the emergence of rankings of nodes that differ from the rankings obtained from one single layer. Results provide support in favor of the salience of multiplex centrality measures, like Multiplex PageRank, for assessing the prominence of nodes embedded in multiple interacting networks, and for shedding a new light on structural properties that would otherwise remain undetected if each of the interacting networks were analyzed in isolation.