On Agent-Based Modeling with Social Networks

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Abstract: Social network analysis has become a staple in the analysis of organizations and societies. Most work has focused on single-mode networks and the analysis of their structures and substructures including dyads, triads and cliques. A modest amount of work has been done on two-mode networks and methods for reducing these to one-mode networks. In this paper we develop the mathematical foundations for multi-mode networks. To put a more concrete face on the application of multi-mode networks, we consider our alcohol model. In our alcohol network, we consider three types of agents, the alcohol abuser, the alcohol distributor, and law enforcement. One could easily image additional agents in the network such as the judicial, as health care providers, as family, as work-place colleagues. In the two-mode network case, the two-mode network can be decomposed into two one-mode networks. Because there is only one unique way of forming the transpose of a two-dimensional matrix, only two one-mode networks result. Consider a three-mode network. Then the three-dimensional cuboid adjacency matrix is a tensor of rank 3. The transpose of the rank 3 tensor can be done in many different ways so that much richer substructures can be formed that can tease out a wide variety of social behaviors. While most agent-based modeling has been done in a geospatial context, we will discuss using agent-based models on a multi-mode social network.