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Modeling Network Evolution Using Graph Motifs

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Network structures are extremely important to the study of political science. Much of the data in its subfields are naturally represented as networks. This includes trade, diplomatic and conflict relationships. The social structure of several organization is also of interest to many researchers, such as the affiliations of legislators or the relationships among terrorist. A key aspect of studying social networks is understanding the evolutionary dynamics and the mechanism by which these structures grow and change over time. While current methods are well suited to describe static features of networks, they are less capable of specifying models of change and simulating network evolution. In the following paper I present a new method for modeling network growth and evolution. This method relies on graph motifs to generate simulated network data with particular structural characteristic. This technique departs notably from current methods both in form and function. Rather than a closed-form model, or stochastic implementation from a single class of graphs, the proposed "graph motif model" provides a framework for building flexible and complex models of network evolution. The paper proceeds as follows: first a brief review of the current literature on network modeling is provided to place the graph motif model in context. Next, the graph motif model is introduced, and a simple example is provided. As a proof of concept, three classic random graph models are recovered using the graph motif modeling method: the Erdos-Renyi binomial random graph, the Watts-Strogatz "small world" model, and the Barabasi-Albert preferential attachment model. In the final section I discuss the results of these simulations and subsequent advantage and disadvantages presented by using this technique to model social networks.

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