CONTINUOUS TIME RANDOM WALKS OVER EVOLVING NETWORKS WITH MUTUAL DEPENDENCY

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Abstract

We study the behaviour of a continuous time random walk moving over a time evolving network in the presence of mutual dependencies. We introduce the model of an *edge-attractor random walk* in which the dynamics of the underlying network depends on the walker position. The walker is edge attractive in the sense that it drives the network towards graph configurations displaying higher degree for the vertex currently occupied by the walker. In particular, assuming the walker is in vertex i, the network transition rate to a possible configuration g is linearly proportional to the degree of vertex i in g. The network evolution, on the other hand, by changing the edge set of the underlying topology, naturally affects the walker behaviour preventing/allowing different walker steps over time. The joint process describing the edge-attractor random walk moving over an evolving network is a continuous time Markov chain which is shown to be time reversible. By exploiting the time reversibility of the joint chain, we characterise the stationary distribution of the edge-attractor random walk. Interestingly, the stationary distribution of the walker does not depend on the particular transitions of the underlying network, but only on the set of possible network configurations. We also provide an example of a network evolution induced by an On-Off edge Markovian process, for which the stationary distribution of the walker can be computed in closed form.

References

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