SCALAR EMBEDDING OF TEMPORAL NETWORK TRAJECTORIES

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A temporal network—represented as a series of snapshots capturing the dynamic formation and dissolution of links—can be viewed as a trajectory within graph space. Embedding the trajectory into a low-dimensional Euclidean space is crucial for effectively examining its complex dynamics with methods drawn from time series analysis and signal processing. In this contribution, we propose that preserving the relative distances between snapshots, rather than their individual topological features, is crucial when performing this embedding. Consequently, we have used dimensionality reduction techniques explicitly focused on maintaining relative distances, such as Multidimensional Scaling (MDS), or treating the distance matrix itself as a feature space suitable for Principal Component Analysis (PCA). We present a straightforward methodology to implement this strategy, demonstrating through applications to both synthetic network trajectory models and empirical datasets that meaningful dynamic characteristics of network trajectories are retained even in scalar embeddings. This result facilitates the application of standard time series analytical techniques to the study of temporal networks.

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[1] L. Lacasa, F. J. Marín-Rodríguez, N. Masuda, and L. Arola-Fernández, Chaos Solitons & Fractals **199**, 116599 (2025). DOI: 10.1016/j.chaos.2025.116599.

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