Reconstruction of Interconnectedness in Networks of Dynamical Systems Based on Passive Observations

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Determining interrelatedness structure of various entities from multiple time series data is of significant interest to many areas. Knowledge of such a structure can aid in identifying cause and effect relationships, clustering of similar entities, identification of representative elements and model reduction. In this talk, a methodology for identifying the interrelatedness structure of dynamically related time series data based on passive observations will be presented. The framework will allow for the presence of loops in the connectivity structure of the network. The quality of the reconstruction will be quantified. Results on the how the sparsity of multivariate Wiener filter, the Granger filter and the causal Wiener filter depend on the network structure will be presented. Connections to graphical models with notions of independence posed by d-separation will be highlighted. Results on the extent of the recovery of the network structure where only a subset of entities are observed and under corruption of data will be highlighted.