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Title: “Novel Algorithm for Causal Structure Learning in Nonlinear Time-Series Data"

Abstract

Unlike traditional time-series analysis, which often focuses on prediction and correlation, causal structure learning (CSL) aims to uncover the cause-and-effect relationships underlying the observed data. CSL is a crucial challenge in numerous fields, such as economics, finance, healthcare, and natural sciences, where understanding the causal mechanisms can lead to more accurate forecasting, better explainability, targeted interventions, and improved risk management.

In general, CSL is challenging due to the presence of unobserved confounding factors, limited observational data, nonstationarity, noise, and many other factors. Traditional methods for CSL mainly focus on contemporaneous data trying to address some of these challenges. However, their extension to time-series data are quite computationally intensive, which makes their applications limited to moderately-sized problems.

In this study, we introduce a novel algorithm for CSL in nonlinear time-series systems that is substantially less computationally intensive than existing methods. We have rigorously tested its performance on synthetic datasets and the results of our experiments demonstrate that it outperforms other methods, especially when dealing with limited historical data