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Causal Discovery using Model Invariance through Knockoff Interventions

Cause-effect analysis is crucial to understand the underlying mechanism of a system. We propose to exploit model invariance through interventions on the predictors to infer causality in nonlinear multivariate systems of time series. We model nonlinear interactions in time series using DeepAR and then expose the model to different environments using Knockoffs-based interventions to test model invariance. Knockoff samples are pairwise exchangeable, in-distribution and statistically null variables generated without knowing the response. We test model invariance where we show that the distribution of the response residual does not change significantly upon interventions on non-causal predictors. We evaluate our method on real and synthetically generated time series. Overall our method outperforms other widely used causality methods, i.e, VAR Granger causality, VARLiNGAM and PCMCI+. The code and data can be found at: https://github.com/wasimahmadpk/deepCausality

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