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Data-Driven Multistage Stochastic Optimization on Time Series

We propose a data-driven framework for multistage stochastic optimization using only a single historical trajectory of the underlying process. Given recent observations of the stochastic process, the goal is to find a policy that minimizes expected cost over the next T time periods. Our approach fits a time-series model to the data and uses its residuals to construct a discrete approximation of the process. The method accommodates nonlinear VARX and multivariate GARCH models and can be solved via stochastic dual dynamic programming. We establish conditions for asymptotic and finite-sample guarantees and demonstrate the approach on a hydrothermal scheduling problem, illustrating benefits even with misspecified time-series models.

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