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Inferring Nonlinear Differential Equation Models from Non-Parameteric Functional Estimators

Differential equation models are a type of functional regression model where the response is a (functional) derivative, and the covariates are the state functions. Parameters quantifying the relationship between derivative and states are typically easily interpretable, making this class of model appealing for understanding mechanisms and relationships. We outline an exploratory method for reverse engineering relationships based on non-parametric methods with the goal of proposing possible parametric nonlinear differential equation models. The method is based on linking kernel estimates of states and derivatives from data through generalized additive models to infer nonlinear relationships.