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Parameter Estimation for Differential Equations: A Generalized Smoothing Approach

We propose a new method for estimating parameters in models defined by a system of non-linear differential equations from noisy measurements on a subset of variables. The approach is based on a modification of data smoothing methods along with a generalization of profiled estimation, and we refer to it as parameter cascading. We derive parameter estimates and confidence intervals for these estimates, and show that these have low bias and good coverage properties, respectively, for data simulated from models in chemical engineering and neurobiology. The performance of the method is demonstrated using real-world data from chemistry and from the progress of the auto-immune disease lupus.