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Estimating Differential Equations from Real Data

Differential equations model the rate of change of a dynamic process. They are widely used in medicine, engineering, ecology and a host of other applications. One central and difficult problem is how to estimate DE parameters from noisy data. We have developed the generalized profiling method to solve this problem. DE solutions are approximated by nonparametric functions, which are estimated by penalized smoothing with DE-defined penalty. This method avoids solving DEs numerically and greatly improves the computational efficiency. We can also estimate variances of DE parameters, and provide their confidence intervals. I will demonstrate our method by estimating a predator-prey dynamic model from some real experimental data.