

# **Statistical Inference for Dynamic models with the Generalized Profiling Method**

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Dynamic models, usually written in forms of differential equations (DEs), describe the rate of change of a 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. The computation is much faster than other methods. A modified delta method is proposed to estimate variances of DE parameters, which include all the uncertainty of the smoothing process. I will demonstrate our method with estimating a predator-prey dynamic model. The generalized profiling method can also be used to estimate other statistical models with nuisance parameters.