Parameter Estimation in Nonlinear Systems using Shadowing Time

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Many open questions remain when estimating parameters of nonlinear systems based on uncertain observations. A new approach to parameter estimation in nonlinear models is presented which aims to improve the balance between information in the observations themselves and information in the dynamics of the model. The approach is new in that it uses shadowing times, complimenting the approach of McSharry and Smith (1999) which is based on the structure of the model's attractor. Parameter estimation based upon shadowing times allows a better combination of information from the dynamics of the model with that from the observations; this approach can provide information on both parameter values and the likely observational noise level simultaneously. The method is illustrated both on low dimensional chaotic flows and maps.

McSharry and Smith (1999): Better Nonlinear Models from Noisy Data: Attractors with Maximum Likelihood. Physical Review Letters, 83(21):4285-4288