PARTICLE FILTERING AND SMOOTHING FOR NONLINEAR DYNAMICS

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ABSTRACT

In a nonlinear dynamical system, the system equation is numerically solved to obtain the future state from the initial conditions that describe the current state of the system. This means that the future state is extremely sensitive to the initial state, so the accuracy of the initial state directly affects the prediction results. The data assimilation method can combine the numerical model with various measurements to adjust the model trajectory, thus improving the estimation accuracy and prediction ability of the dynamic model.
In this paper, we used particle filtering and smoothing methods in data assimilation. Firstly, the particle filtering method is used to estimate the current optimal state, and then the smoothing method is used to get the optimal initial state. Finally, the particle filtering and smoothing methods are applied to the Double-well potential model and compared with the optimal solution obtained by numerical discretization of the Kolmogorov forward equation and Kolmogorov backward equation to evaluate the performance of the particle filtering and smoothing methods.

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