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PARAMETER UNCERTAINNTY OF CHAOTIC SYSTEMS

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Parameter identification of chaotic systems is complicated by the fact that slightly different initial state or parameter values, or even the very same values but different solver settings, typically lead to totally different trajectories after an initial predictable time interval. So, classical solutions such as least squares minimization does not exist for such systems on large time interval integrations in the same sense as for deterministic models. We show that it is possible to construct a likelihood free of the above pitfalls. Instead of trying to follow a specific trajectory of given data, we further develop the approach introduced in [1] to create Gaussian feature vectors using the available data. With several examples we demonstrate how these likelihoods allow a robust parameter estimation and subsequent MCMC samplig of the parameter posteriors. The applications include both classical chaotic systems and their stochastic extensions.

References

[1] Haario H, Kalachev L., Hakkarainen J. (2015). *Generalized Correlation integral vectors: A distance concept for chaotic dynamical systems*, Chaos: An Interdisciplinary Journal of Nonlinear Science Volume 25, Issue 6, 25, 063102.

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