Approximate Bayesian Computation with Path Signatures

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Abstract
Simulation models often lack tractable likelihood functions, making likelihood-free inference methods indispensable. Approximate Bayesian computation (ABC) generates likelihood-free posterior samples by comparing simulated and observed data through some distance measure, but existing approaches are often poorly suited to time series simulators, for example due to an independent and identically distributed data assumption. In this talk, we will discuss our work on the use of path signatures in ABC as a means to handling the sequential nature of time series data of different kinds. We will begin by discussing popular approaches to ABC and how they may be extended to time series simulators. We will then introduce path signatures, and discuss how signatures naturally lead to two instances of ABC for time series simulators. Finally, we will demonstrate that the resulting signature-based ABC procedures can produce competitive Bayesian parameter inference for simulators generating univariate, multivariate, irregularly spaced, and even non-Euclidean sequences.

References

[1] J. Dyer, P. Cannon, S. M Schmon (2022). Approximate Bayesian Computation with Path Signatures. Preprint at arXiv:2106.12555.