Asymptotic comparison of nonparametric jump rate estimators for one-dimensional piecewise-deterministic Markov processes

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Piecewise-deterministic Markov processes (PDMPs) offer a powerful stochastic modeling framework that combines deterministic trajectories with random perturbations at random times. Estimating their local characteristics (particularly the jump rate) is an important yet challenging task. Several nonparametric methods for jump rate estimation have been introduced in recent years [2, 3, 4, 5], each grounded in distinct theoretical settings, which has made direct and systematic comparison difficult.

In this context, a unified framework is introduced to standardize and consolidate state-of-the-art approaches. Within this setting, new results are established concerning consistency and asymptotic normality of the estimators, allowing for a rigorous comparison in terms of convergence rates and asymptotic variances. Notably, it is shown that no single method uniformly outperforms the others, even within the same model. These theoretical insights are validated through numerical simulations using a representative PDMP application: the TCP model. Finally, the estimators are applied to experimental data describing cell growth and division in *Escherichia coli*, highlighting their practical relevance.

This abstract is based on the preprint [1], submitted in early 2025.

References

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