



# Regularized bridge-type estimation with multiple penalties

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## Abstract

The aim of this paper is to introduce an adaptive penalized estimator for identifying the true reduced parametric model under the sparsity assumption. In particular, we deal with the framework where the unpenalized estimator of the structural parameters needs simultaneously multiple rates of convergence (i.e., the so-called mixed-rates asymptotic behavior). We introduce a bridge-type estimator by taking into account penalty functions involving  $\ell^q$  norms ( $0 < q \leq 1$ ). We prove that the proposed regularized estimator satisfies the oracle properties. Our approach is useful for the estimation of stochastic differential equations in the parametric sparse setting. More precisely, under the high-frequency observation scheme, we apply our methodology to an ergodic diffusion and introduce a procedure for the selection of the tuning parameters. Furthermore, the paper contains a simulation study as well as a real data prediction in order to assess about the performance of the proposed bridge estimator.

**Keywords** High-frequency scheme · Oracle properties · Multidimensional diffusion processes · Prediction accuracy · Penalized estimation · Quasi-likelihood function

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