A computationally-tractable measure of global sensitivity for sampling-based Bayesian inference

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Abstract
Bayesian inference can be sensitive to the choice of hyperparameters of the prior or likelihood, yet defining and quantifying this sensitivity in a principled and computationally feasible way remains challenging. Existing methods are rarely applicable in modern Bayesian workflows due to high computational cost and poor performance in moderate to high dimensions. We introduce a framework for global sensitivity analysis based on the Fisher divergence, requiring only samples from a reference posterior and the ability to evaluate score functions. Under regularity conditions, it controls changes in the whole posterior and bounds the impact of perturbations on the first two moments, at negligible cost relative to MCMC. We also propose a generalisation that lifts the restriction to parametric families by letting candidate priors range over divergence balls around a reference prior, without sacrificing efficiency. We demonstrate both on problems out of reach of existing approaches, including generalised Bayesian inference for unnormalised models, Bayesian time series, neural simulation-based inference, and Bayesian neural networks.

Keywords: Global Bayesian sensitivity analysis, Fisher divergence, Robust Bayesian inference.

Reference:
A. Odnoblyudova, C. Dellaporta, F.X. Briol. A computationally-tractable measure of global sensitivity for sampling-based Bayesian inference. Preprint at arXiv: 2605.28099, 2026.