

# Approximate Bayesian Computation with Statistical Distances for Model Selection

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## **Abstract**

Model selection is a key task in statistics, playing a critical role across various scientific disciplines. While no model can fully capture the complexities of a real-world data-generating process, identifying the model that best approximates it can provide valuable insights. Bayesian statistics offers a flexible framework for model selection by updating prior beliefs as new data becomes available, allowing for ongoing refinement of candidate models. This is typically achieved by calculating posterior probabilities, which quantify the support for each model given the observed data. However, in cases where likelihood functions are intractable, exact computation of these posterior probabilities becomes infeasible. Approximate Bayesian computation (ABC) has emerged as a likelihood-free method and it is traditionally used with summary statistics to reduce data dimensionality, however this often results in information loss difficult to quantify, particularly in model selection contexts. Recent advancements propose the use of full data approaches based on statistical distances, offering a promising alternative that bypasses the need for handcrafted summary statistics and can yield posterior approximations that more closely reflect the true posterior under suitable conditions. Despite these developments, full data ABC approaches have not yet been widely applied to model selection problems. This paper seeks to address this gap by investigating the performance of ABC with statistical distances in model selection. Through simulation studies and an application to toad movement models, this work explores whether full data approaches can overcome the limitations of summary statistic-based ABC for model choice.

**Keywords:** model choice, distance metrics, full data approaches.

## **Reference:**

C. Grazian. Approximate Bayesian Computation with Statistical Distances for Model Selection. Preprint at ArXiv:2410.21603, 2025.