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Exploring the feasibility of neural likelihood estimators to speed up gravitational waves inference for 3rd generaton gravitational waves detectors

Gravitational-wave (GW) astronomy has become routine with almost 200 GW detections in the ongoing observing run of the current network of ground-based detectors. With the next generation of GW detectors with higher sensitivities being planned, the volume and the complexity of the detected signals are expected to rise dramatically, increasing the computational cost and resources of running Bayesian analysis to unsustainable levels. Many alternatives to classic stochastic sampling algorithms have recently been proposed, particularly implementing machine learning components in the Bayesian frameworks. In this work we explore the capabilities and the limits of neural likelihood estimators (NLE) in the context of GW analysis, comparing computational costs and accuracy with standard samplers. We apply our method to simulations as well as real GW signals and show that we are capable of reproducing the posterior probablity distribution functions of parameters with a reduction in computational costs by a factor of ~50. Although our proposed method has its limitations, we show that NLEs show promise as a cheap and flexible framework for GW data analysis.

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