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Improved gravitational wave parameter estimation with SBI and secondary mode marginalization

Simulation-based inference (SBI) has emerged as a powerful tool for parameter estimation, particularly in complex scenarios where traditional Bayesian methods are computationally intractable. In this work, we build upon a previous application of SBI, based on truncated neural posterior estimation (TNPE), to estimate the parameters of a gravitational wave post-merger signal, using real data from the GW150914 event. We extend this approach by incorporating marginalization over secondary modes, which are often neglected in standard analyses under the assumption that their contribution is weaker than noise and can therefore be absorbed into a Gaussian noise model. However, when secondary modes have a non-negligible impact, this assumption can introduce biases in the inferred parameters of the dominant mode. By explicitly accounting for these contributions within the SBI framework, we investigate whether this refinement improves both the accuracy and robustness of parameter estimation compared to standard Bayesian methods.

AI keywords

simulation-based inference; neural posterior estimation; normalizing flows; regression

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