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Cosmological inference using gravitational waves and normalizing flows

We present a machine learning approach using normalizing flows for inferring cosmological parameters from gravitational wave events. Our methodology is general to any type of compact binary coalescence event and cosmological model and relies on the generation of training data representing distributions of gravitational wave event parameters. These parameters are conditional on the underlying cosmology and incorporate prior information from galaxy catalogues. We provide an example analysis inferring the Hubble constant using binary black holes detected during the O1, O2, and O3 observational runs conducted by the advanced LIGO/VIRGO gravitational wave detectors. We obtain a Bayesian posterior on the Hubble constant from which we derive an estimate and 1σ confidence bounds of H0 = 74.51 +14.80 −13.63 km s−1 Mpc−1.
We are able to compute this result in O(1) s using our trained normalizing flow model.

AI keywords

simulation-based inference; normalizing flows; multi layered perceptrons;

Primary author: STACHURSKI, Federico (Univeristy of Glasgow)

Presenter: STACHURSKI, Federico (Univeristy of Glasgow)

Track Classification: Simulations & Generative Models