Poster Session #D
Binary sources of Gravitational Waves and cosmology

D10

Exploring gravitational-wave detection and parameter inference using Deep Learning methods

Osvaldo Freitas (University of Minho)

We explore machine learning methods to detect gravitational waves (GW) from binary black hole (BBH) mergers using deep learning (DL) algorithms. The DL networks are trained with gravitational waveforms obtained from BBH mergers with component masses randomly sampled in the range from 5 to 100 solar masses and luminosity distances from 100 Mpc to, at least, 2000 Mpc. The GW signal waveforms are injected in public data from the O2 run of the Advanced LIGO/Virgo detectors, in time windows that do not coincide with those of known detected signals. We demonstrate that DL algorithms, trained with GW signal waveforms at distances of 2000Mpc, still show high accuracy when detecting closer signals, within the ranges considered in our analysis. Moreover, by combining the results of the three-detector network in a unique RGB image, the single detector performance is improved by as much as 70%. Furthermore, we train a regression network to perform parameter inference on BBH spectrogram data and apply this network to the events from the GWTC-1 and GWTC-2 catalogues. Without significant optimization of our algorithms, we obtain results that are mostly consistent with published results by the LIGO-Virgo Collaboration. In particular, our predictions for the chirp mass are compatible (up to 3σ) with the official values for 90% of events.