

Detecting gravitational waves from extreme mass ratio inspirals using convolutional neural networks

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Extreme mass ratio inspirals (EMRIs) are among the most interesting gravitational wave (GW) sources for space-borne GW detectors. However, successful GW data analysis remains challenging due to many issues, ranging from the difficulty of modeling accurate waveforms, to the impractically large template bank required by the traditional matched filtering search method. In this work, we introduce a proof of principle approach for EMRI detection based on convolutional neural networks (CNNs). We demonstrate the performance with simulated EMRI signals buried in Gaussian noise. We show that over a wide range of physical parameters, the network is effective for EMRI systems with a signal-to-noise ratio larger than 50, and the performance is most strongly related to the signal-to-noise ratio. The method also shows good generalization ability toward different waveform models. Our study reveals the potential applicability of machine learning technology like CNNs toward more realistic EMRI data analysis.

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