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Detecting gravitational waves using convolutional neural networks.

The first detection of the gravitational wave event GW150914 in 2015 opened the doors to the gravitational astronomy. Since then, hundreds of such events have been detected. Some of these have been particularly significant, such as GW170817, the first binary neutron star merger. This detection enabled a measurement of electromagnetic counterpart marking the beginning of the multi-messenger astrophysics with gravitational waves. Detecting such events is extremely challenging. The challenges go from noise isolation in interferometers to the data analysis techniques used to identify and characterize the signals in the interferometric data. In this context, machine learning techniques have been deeply explored as potential solutions to the gravitational wave detection. In this work, we explore a possible solution in data analysis for discovering binary neutron star events, which so far have represented the biggest challenge for machine learning method. Exploiting simulated data that includes Gaussian noise, transient noise and gravitational wave signals, a Residual Network is trained and tested to recognize the presence of a gravitational wave signal in the data. We compare the performance of this approach with well-established methods that are used presently for the detection of gravitational waves.

AI keywords

Deep Learning; Residual Network; anomaly detection;

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Track Classification: Patterns & Anomalies