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A Machine learning approach to detect IMBH signals

Intermediate mass black holes (IMBH) with mass ranges between $100M_{\odot}$ to $10^5M_{\odot}$ provide a missing link between stellar mass and supermassive black holes. Understanding them provides an insight into galaxy formation as they are considered to be the precursors of supermassive black holes. The high mass of IMBH binaries leads to a short gravitational wave signal duration and bandwidth in current generation GW detectors. Instrumental transients or glitches mimic these signals and can thus raise false alarms. These issues can be circumvented by using stricter signal-glitch discriminators as was done by the PyCBC-IMBH pipeline. Machine learning (ML) algorithms provide an alternate approach to this problem since they can be trained to distinguish between signals and glitches. In this talk, I will present a new method that takes advantage of CNNs'(Convolutional Neural Networks') feature extraction ability to distinguish between spectrograms of signals and glitches. The improved separation between noise and signal will allow the detection of weaker signals previously buried in noise, increasing the search sensitivity. This search, which is based on the pre-existing THAMES algorithm, is trained on various classes of glitches, quasi-circular quadrupole and multipole signals. This enables it to probe complex signal morphologies and in certain cases, THAMES performs better than the PyCBC-HM search which includes higher order modes. Our work thus aims to make ML based searches a staple in future observing runs.

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