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Towards an anomaly detection pipeline for gravitational waves at the ET

We present a study of deep convolutional autoencoders applied to anomaly detection of GW signals. This initial work focuses on short-duration signals (< 2s), corresponding to mergers that involve, or form, intermediate mass black holes. Such burst signals are notably difficult to disentangle from both background noise and glitches that may occur during data taking. We utilise the simulated noise and merger catalogue provided as part of the ET Mock Data Challenge. Weak supervision is employed during training, whereby the model is directly optimised to separate 2D spectrograms containing signal (injected into ET noise) from those containing only noise. With the addition of the weak supervision, the model is able to recover all targeted IMBH merger signals from the MDC dataset. Furthermore, it was found that the model could generalize to mass ranges below this, which were unseen during training. Work is currently ongoing to expand the method towards 3-way classification of signals, glitches and noise, with the goal of developing an model-independent autoencoder based detection/classification pipeline, that is capable of handling the high event rates expected in the ET-era.

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