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Demonstration of Machine Learning-assisted real-time noise regression in LIGO

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Gravitational wave (GW) detectors such as advanced LIGO, advanced Virgo, and KAGRA are high-precision instruments that record the strain signals from transient astrophysical sources such as merging binary black holes. The sensitivities of these detectors are often limited by instrumental and environmental noise that couple non-linearly to the GW strain. Noise regression algorithms running as close as possible to real-time are therefore important for maximizing the science outcomes of these interferometers. DeepClean is a deep learning convolutional neural network algorithm for the subtraction of non-linear and non-stationary noise from GW strain data. DeepClean computes the noise contamination with the help of auxiliary witness sensors that record those instrumental and environmental random processes. We deploy DeepClean as a low-latency noise-regression algorithm for LIGO data and demonstrate the performance in terms of latency, signal-to-noise ratio, and astrophysical parameter estimation.

Primary author: CHOLAYIL, Muhammed Saleem (University of Minnesota)

Co-authors: GUNNY, Alec; COUGHLIN, Michael (University of Minnesota); RANKIN, Dylan Sheldon (Massachusetts Inst. of Technology (US)); KATSAVOUNIDIS, Erik (MIT); HARRIS, Philip Coleman (Massachusetts Inst. of Technology (US))

Presenter: CHOLAYIL, Muhammed Saleem (University of Minnesota)

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