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Machine Learning in the LIGO-Virgo Era

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As LIGO-Virgo moved from the first to the second observation run, 2015-17, the rapid maturation of Machine Learning (ML) algorithms industry-wide enabled an increasing number of researchers to engage in a diversity of applied ML projects at the LIGO Scientific and Virgo Collaborations. Furthermore, multiple detection events have enabled a transition from simulated signals to a more robust landscape of real data analysis and note-worthy results. Currently several areas of ML research are being pursued by LV researchers, including: a means to both classify and locate the source of transient artifacts known as glitches; tested localization of desired signal as produced by coalescing binary black holes and neutron stars; as a single-detector case for supernovae; and as a potential, future means to lock an interferometer. The algorithms employed include Random Forest, Genetic Programming (GP), Convolutional Neural Networks, RNN Auto-encoders, Deep Filtering and Deep Regression. This talk will provide a comprehensive overview of the diverse applications of ML in the LIGO Scientific and Virgo Collaborations, the opportunity for engaging citizen scientists, and a deeper discussion of the application of GP to understand the origin of mechanical couplings in the detectors.