Abstract Submitted
for the APR18 Meeting of
The American Physical Society

Deep Learning for Real-time Gravitational Wave Detection and Parameter Estimation: Results with Advanced LIGO Data[1] DANIEL GEORGE, E. A. HUERTA, NCSA, University of Illinois at Urbana-Champaign — The recent detections of gravitational waves from merging black holes and the subsequent detection of the collision of two neutron stars in coincidence with electromagnetic observations have inaugurated a new era of multimessenger astrophysics. To enhance the scope of this emergent science, we proposed the use of deep learning with convolutional neural networks for detecting and characterizing gravitational wave signals in real-time. Here we present the first application of deep learning using continuous real data streams from multiple LIGO detectors for both detection and parameter estimation of gravitational waves from binary black hole mergers. We show for the first time that machine learning can detect and estimate the true parameters of real GW events. Our comparisons show that deep learning is far more computationally efficient than matched-filtering, while retaining similar accuracy, allowing real-time processing of weak time-series signals in non-stationary non-Gaussian noise, with minimal resources, and also enables the detection of new classes of gravitational wave sources that may go unnoticed with existing algorithms. This approach is uniquely suited to enable coincident detection campaigns of gravitational waves and their multimessenger counterparts in real-time.

[1]This research is supported by the Blue Waters sustained-petascale computing project (NSF awards OCI-0725070 and ACI-1238993) and XSEDE (TG-PHY160053). Eccentric numerical relativity simulations were performed with the open-source Einstein Toolkit.

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Date submitted: 26 Nov 2017 Electronic form version 1.4