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Tools and Results for Real-Time Deep Learning in Gravitational-Wave Physics

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Deep Learning (DL) applications for gravitational-wave (GW) physics are becoming increasingly common without the infrastructure to be validated at-scale or deployed in real-time. With ever more sensitive GW observing runs beginning in 2023, the tradeoff between speed and data robustness must be bridged in order to create experimental pipelines which take shorter to iterate upon and which produce results that are both more conclusive and more reproducible. We present a set of libraries, *ml4gw* and *hermes*, which allow for the development of DL-powered GW physics applications which are faster, more intuitive, and better able to leverage the powerful modeling techniques available in the GW literature. Within these frameworks we present the latest results for *aframe*, an end-to-end pipeline for Binary Black Hole (BBH) merger detection, showing the power of a robust validation and deployment framework. We further with results for a real-time parameter estimation algorithm for un-modeled burst-type GW signals using likelihoodfree inference with normalizing flows.

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