Ethan Marx

847-917-1148 | emarx@mit.edu | github.com/ethanmarx

Education

Massachusetts Institute of Technology — Cambridge, MA
PhD in Physics, Statistics, and Data Science — *Expected November 2025*

Northwestern University — Evanston, IL
BA in Physics and Mathematics — *June 2019*

Experience

PhD Candidate, IAIFI and A3D3 Junior Investigator — September 2019 – Present
Massachusetts Institute of Technology — *Cambridge, MA*

- Built robust end to end pipeline for training deep neural networks to detect gravitational waves from binary black hole mergers with an emphasis on scalability, embedding physics, and low-latency detection.
- Reduced latency to detection compared with traditional methods by > 5 seconds, enabling rapid electro-magnetic followup of events, and increasing likelihood of a multi-messenger detection.
- Developed deep-learning based likelihood free inference framework for low-latency sky localization and parameter estimation of gravitational wave source properties, reducing analysis latency to ~ 1 second, compared to $\sim$ days timescale for traditional Bayesian Monte-Carlo methods.
- Deployed ensemble of neural-network models into production for real-time detection and parameter estimation of gravitational wave sources.
- Leader of a group of graduate and undergraduate students, developing novel research directions for them to explore; Guiding them to become competent contributors to complex shared code bases on github; Helping them become high functioning independent researchers, with significant contributions to published papers.

Undergraduate Researcher — Summers 2016 – 2018
Northwestern University — *Evanston, IL*

- Curated datasets of anomalous noise sources present in gravitational wave detectors to improve deep-learning based noise identification models.
- Developed Python tools for deriving informative features from photometric supernovae light curve timeseries data in service of classification tasks.

Additional Projects

ml4gw | *Python, PyTorch*
Open-source Python library containing PyTorch implementations of common gravitational wave signal processing techniques, enabling real-time, GPU accelerated data augmentations for training machine learning models.

mldatafind | *Python, HTCondor, Slurm*
Modular Python tool kit for scaling gravitational wave data generation tasks to 100's of nodes across high performance computing clusters using HTCondor or Slurm schedulers.

hermes | *Python, TensorRT, NVIDIA Triton*
Python library consisting of tools for exporting, accelerating and deploying trained neural network models with NVIDIA's Triton inference server.

Selected Publications

1. **E. Marx**, W. Benoit, A. Gunny et al. *Machine-learning pipeline for real- time detection of gravitational waves from compact binary coalescence's*, Phys. Rev. D 111, 042010 (2024), arXiv:2403.18661
2. **E. Marx**, W. Benoit, et al. *Machine learning-enabled search for binary black hole mergers in LIGO-Virgo-KAGRA's third observing run*, Phys. Rev. D 112, 043007 (2025), arXiv:2505.21261
3. **E. Marx**, D. Chatterjee, M. Desai et. al *Likelihood-free inference for gravitational-wave data analysis and public alerts*, , submitted to Phys. Rev. D
4. D. Chatterjee, **E. Marx** et al. *Rapid Likelihood Free Inference of Compact Binary Coalescences using Accelerated Hardware*, Mach. Learn.: Sci. Technol. 5 045030 (2024), arXiv:2407.19048

Technical Skills

Languages and Tools: Python, Conda, Poetry, Bash, Git, Github CI/CD, Docker, Apptainer, Kubernetes, HTCondor
Libraries: pytorch, numpy, scipy, pandas, scikit-learn, bokeh, matplotlib