Jiawei Guo

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EDUCATION

CARNEGIE MELLON UNIVERSITY, Pittsburgh, Pennsylvania, U.S. *Aug. 2021-May. 2026*
Doctor of Philosophy (Ph.D.) in Physics

SHANDONG UNIVERSITY, Jinan, Shandong, China *Sept. 2017-Jun. 2021*
Bachelor of Science (B.S.) in Physics

DUKE UNIVERSITY, Durham, North Carolina, U.S. *Aug. 2019-May. 2020*
Visiting International Student, Physics

EXPERIENCE

AI/ML Assisted Experiment Control *Mar. 2024-Present*
Graduate Research Assistant Pittsburgh, PA

- The objective is to develop and train a **reinforcement learning** model for **real-time control** of the radiator rotation, ensuring the production of a polarized photon beam with the precise energy required for the GlueX experiment.
- Developed an **automated** data collection pipeline in **Python**, processing and transforming **500MB** historical experiment control data into **CSV** format, optimizing data accessibility and facilitating streamlined analysis and model training.
- Conducted **exploratory** and **correlation analysis** to identify most relevant variables influencing photon energy.
- Trained and optimized a surrogate model using **Gaussian Process Regression** to map photon energy from relevant variables and integrated the model into the custom RL environment built with the **OpenAI gymnasium**.
- Implemented **DDPG and TD3** algorithms using **TensorFlow** to train reinforcement learning agents. Enhanced agent performance by the refining observation space, reward function, and **fine-tuning** model hyperparameters.

GlueX Experiment Software Engineering and Data Analysis *Aug. 2021-Present*
Graduate Research Assistant Pittsburgh, PA

- Established a processing **pipeline in C++** and processed over **25TB** experimental data using computing clusters at CMU.
- Implemented a **statistical weighting method**, applied event-by-event, to disentangle the contributions of different decay processes in the data, effectively separating signal from background channels and improving the data purity.
- Performed partial wave analysis based on **maximum likelihood estimation** (MLE) with **gradient descent** optimization and **parallel computing** with **MPI and GPUs**, **optimizing models** to extract physics insights.
- Led the study of **mathematical ambiguity** in the MLE analysis, demonstrating that multiple parameter sets can yield the same likelihood. Derived criteria for the occurrence of ambiguity, which were verified by **Monte Carlo simulations**.
- Developing **LASSO regularization** technique in **C++** to enhance **model selection** for the partial wave analysis.

Algorithm Development for PandaX-4T Supernova Early Warning *Nov. 2020-Jun. 2021*
Research Assistant Shandong, China

- Developed an **object-oriented sliding window algorithm** in **C++** for the prompt detection of supernova bursts.
- Implemented **Monte Carlo simulation** to assess the algorithm's performance in **classifying** supernova burst signals amidst Poisson-distributed background noise, ensuring accurate detection capabilities.
- Achieved a 99.73% **true positive rate** and limited the **false positive frequency** to once a week with optimized parameters.

PROJECTS

Image Captioning *CMU | Mar. 2022-May. 2022*

- Built an image captioning model with **attention mechanism** and **CNNs** for both vision and language using **PyTorch**.
- Applied a **hierarchical attention module** where attention vectors are computed at each level of the CNN language model and iteratively fed back into the subsequent levels to enhance contextual understanding.
- Trained the model with **110K** images from MSCOCO dataset, achieving BLEU scores around 52, demonstrating performance comparable to that of published LSTM-based models.

TECHNICAL SKILLS

- Programming Language: Python, C, C++, Shell script, SQL
- Toolkit: PyTorch, TensorFlow, Scikit-Learn, Pandas, Matplotlib, Seaborn, Numpy, ROOT, GEANT4
- Software: Git, Docker, Slurm, Mathematica, Tableau
- Specialties: Machine Learning, Reinforcement Learning, Statistical Modeling, Data Analysis