

# Jiawei Guo

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## EDUCATION

CARNEGIE MELLON UNIVERSITY, Pittsburgh, Pennsylvania, U.S. <i>Doctor of Philosophy (Ph.D.) in Physics</i>	<i>Aug. 2021-May. 2026</i>
SHANDONG UNIVERSITY, Jinan, Shandong, China <i>Bachelor of Science (B.S.) in Physics</i>	<i>Sept. 2017-Jun. 2021</i>
DUKE UNIVERSITY, Durham, North Carolina, U.S. <i>Visiting International Student, Physics</i>	<i>Aug. 2019-May. 2020</i>

## EXPERIENCE

<b>AI/ML Assisted Experiment Control</b> Graduate Research Assistant	<i>Mar. 2024-Present</i> Pittsburgh, PA
<ul style="list-style-type: none"><li>The objective is to develop and train a <b>reinforcement learning</b> model for <b>real-time control</b> of the radiator rotation, ensuring the production of a polarized photon beam with the precise energy required for the GlueX experiment.</li><li>Developed an <b>automated</b> data collection pipeline in <b>Python</b>, processing and transforming <b>500MB time-series</b> experiment control data into <b>CSV</b> format, optimizing data accessibility and facilitating streamlined analysis and model training.</li><li>Conducted <b>exploratory</b> and <b>correlation analysis</b> to identify most relevant variables influencing photon beam energy.</li><li>Trained and optimized a surrogate model using <b>Gaussian Process Regression</b> to map photon energy from relevant variables and integrated the model into the custom RL environment built with the <b>OpenAI gymnasium</b>.</li><li>Implemented <b>DDPG</b> and <b>TD3</b> algorithms using <b>TensorFlow</b> to train reinforcement learning agents. Enhanced agent performance by the refining observation space, reward function, and <b>fine-tuning</b> model hyperparameters.</li></ul>	
<b>GlueX Experiment Software Engineering and Data Analysis</b> Graduate Research Assistant	<i>Aug. 2021-Present</i> Pittsburgh, PA
<ul style="list-style-type: none"><li>Established a processing <b>pipeline in C++</b> and processed over <b>25TB</b> experimental data using computing clusters at CMU.</li><li>Implemented a <b>statistical weighting method</b>, 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.</li><li>Performed partial wave analysis based on <b>maximum likelihood estimation (MLE)</b> with <b>gradient descent optimization</b> and <b>parallel computing</b> with <b>MPI and GPUs</b>, <b>optimizing</b> and <b>fine-tuning models</b> to extract physics insights.</li><li>Led the study of <b>mathematical ambiguity</b> 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 <b>Monte Carlo simulations</b>.</li><li>Developing <b>LASSO regularization</b> technique in C++ to enhance <b>model selection</b> for the partial wave analysis.</li></ul>	
<b>Algorithm Development for PandaX-4T Supernova Early Warning</b> Research Assistant	<i>Nov. 2020-Jun. 2021</i> Shandong, China
<ul style="list-style-type: none"><li>Developed an <b>object-oriented sliding window algorithm</b> in C++ for the prompt detection of supernova bursts.</li><li>Implemented <b>Monte Carlo simulation</b> to assess the algorithm's performance in <b>classifying</b> supernova burst signals amidst <b>Poisson-distributed</b> background noise, ensuring accurate distinguishing capabilities.</li><li>Achieved a 99.73% <b>true positive rate</b> and limited the <b>false positive frequency</b> to once a week with optimized parameters.</li></ul>	

## PROJECTS

<b>Image Captioning</b>	<i>CMU   Mar. 2022-May. 2022</i>
<ul style="list-style-type: none"><li>Built 2 models with <b>PyTorch</b>, one using <b>CNN+CNN</b> for vision and language, the other using <b>CNN+Transformer</b>.</li><li>Applied <b>hierarchical attention mechanism</b> for CNN+CNN model, achieving results comparable to LSTM-based models.</li><li>Trained models with <b>10K</b> images from MSCOCO dataset, demonstrating the CNN+Transformer model outperforms CNN- and LSTM-based models by <b>10%</b>, with a BLEU-1 score around 70. See our final report <a href="#">here</a>.</li></ul>	

## 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, Deep Learning, Reinforcement Learning, Statistical Modeling, Data Analysis, Natural Language Processing, Multimodal Learning, Generative Models, Time Series Analysis, Online Learning