

RYAN LIU

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EDUCATION

University of California, Berkeley
B.A., Computer Science and Physics

August, 2021 - May, 2025
GPA: 4.00/4.00

National Taiwan University
Precollege Student

September, 2020 - June, 2021
GPA: 4.17/4.3

RESEARCH EXPERIENCE

Berkeley Artificial Intelligence Research, AI+Science group
Supervisor: Prof. Aditi Krishnapriyan

May 2024 - Ongoing

Fermi National Accelerator Laboratory, AI for HEP
Supervisor: Dr. Jennifer Ngadiuba

Aug 2023 - May 2024

California Institute of Technology, Caltech SURF

Jun 2023 - Aug 2023

Supervisor: Prof. Maria Spiropulu, Co-supervisor: Dr. Jennifer Ngadiuba, Dr. Jean-Roch Vlimant

Lawrence Berkeley National Laboratory, GNN4ITk
Supervisor: Dr. Paolo Calafiura

Nov 2021 - May 2024

PUBLICATION

Ryan Liu, Abhijith Gandrakota, Jennifer Ngadiuba, Maria Spiropulu, Jean-Roch Vlimant. (2023).
“Fast Particle-based Anomaly Detection Algorithm with Variational Autoencoder” *Accepted to Neurips Machine Learning and the Physical Sciences Workshop 2023*.

Ryan Liu, Abhijith Gandrakota, Jennifer Ngadiuba, Maria Spiropulu, Jean-Roch Vlimant. (2023).
“Efficient and Robust Jet Tagging at the LHC with Knowledge Distillation” *Accepted to Neurips Machine Learning and the Physical Sciences Workshop 2023*.

Ryan Liu, Paolo Calafiura, Steven Farrell, Xiangyang Ju, Daniel Thomas Murnane, Tuan Minh Pham (2023). “Hierarchical Graph Neural Networks for Particle Track Reconstruction” *Accepted to 21st International Workshop on Advanced Computing and Analysis Techniques in Physics Research*.

PROJECT

Pure Transformer for Molecular Dynamics and Material Simulation

BAIR

May 2024 - Ongoing

As an attempt to remove computationally inefficient equivariance that are commonly used in molecular dynamics models, we devised a sparse transformer which achieved competitive performance on MD22 and Open Catalyst Project.

Fast Anomaly Detection with Variational Autoencoder for CMS L1T

Caltech SURF, Fermilab

June 2023 - August 2023

We proposed a novel decoding framework for particle-based autoencoders which demonstrated a 2x improvement in signal efficiency from n-subjettiness method in anomaly detection and a novel training technique to make KL-divergence a good anomaly score for particle-based VAEs.

Transfer Inductive Biases with Knowledge Distillation

Caltech SURF, Fermilab

June 2023 - August 2023

We showed that knowledge distillation can improve accuracy of a light-weight jet tagger and demonstrated that knowledge distillation can induce the bias in student network to yield better robustness.

Hierarchical Graph Neural Networks for Particle Track Reconstruction

LBNL

April 2022 - October 2022

We showed that knowledge distillation can improve accuracy of a light-weight jet tagger and demonstrated that knowledge distillation can induce the bias in student network to yield better robustness.

Novel Training Frameworks for Tracker Data

LBNL

March 2024 - Ongoing

We explore various training objectives including event-level anomaly detection and Point cloud Joint Embedding Predictive Architecture (P-JEPA) and training techniques such as curriculum learning.

Foundation Model for High Energy Physics

Fermilab

February 2024 - Ongoing

To facilitate development of foundation model for high energy physics, we generated a large event-level dataset with fast simulation and developed relevant framework for machine learning usages.

Diffusion-Based State Sampler for Synthetic Experience Replay

UC Berkeley

September 2023 - December 2023

We developed a sample efficient online-reinforcement learning algorithm with synthetic experience replay from diffusion model and world model, which provided a significant speed-up in convergence compared with vanilla SAC.

Pintos Educational Operating System

UC Berkeley

January 2024 - May 2023

We implemented a single-core operating system that supports multi-processing, multi-threading, scheduling, and hierarchical file system. I led the design and implementation process of the four-person team.

Zero Tidal Love Number of Schwarzschild Black Holes

National Taiwan University

January 2021 - June 2021

We computed perturbative expansion of Einstein equation near Schwarzschild background and rederived the zero tidal Love number for Schwarzschild black holes with detailed computation

SELECTED COURSEWORK

UC Berkeley

Deep Reinforcement Learning, Decision Making, and Control¹: A

Operating Systems and System Programming: A+

Quantum Theory of Measurement¹: A+

National Taiwan University

Quantum Information and Computation¹: A+

Computational Physics¹: A

Machine Learning¹: A+

General Relativity¹: A+

AWARDS

Gold Medal, European Physics Olympiad 2020

July 2020

Ranked 15th place and 1st place in Taiwan National Team.

¹Graduate Class