

KEVIN HAN

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Education

University of Texas At Austin

Austin, TX

Bachelors of Science (3) in Physics, Mathematics, and Astronomy, 3.92 GPA

August 2021 - May 2025

- **Minors:** Elements of Computing, Scientific Computation and Data Sciences, Computational Science and Engineering
- **Relevant Coursework:** Math for Machine Learning, Data Structures & Algorithms, Decision Analytics, Stochastic Processes, Numerical Analysis, Data Science, Differential Equations with Linear Algebra, Applied Linear Algebra, Abstract Algebra, Discrete Math, Vector Calculus, Probability, Statistics, Lagrangian/Hamiltonian Mechanics, Quantum Physics I - III, Modern Physics Laboratory

Technical Skills

Programming: Proficient in Python, including the NumPy, PyTorch, Matplotlib and SKLearn libraries. Also experienced with Java and MATLAB.

Quantitative: Reinforcement learning, deep learning, numerical analysis, Monte Carlo, control theory, optimization.

Research Experience

Learning Agents Research Group

Austin, TX

Undergraduate Researcher in Dr. Peter Stone's Reinforcement Learning (RL) Lab

August 2024 - Present

- Collaborating with NYU's Department of Psychology to model unsupervised pretraining/exploration algorithms based on human infant exploration
- Creating RL environments and tasks based on object interactions in the infant experiment setting while converting raw experimental data to a MDP formalism
- Constructing baseline algorithms such as Active Pre-Training using Particle-Based Entropy Maximization combined with a PPO policy optimizer

Columbia University

New York City, NY

Amazon SURE Fellow in Dr. Brian Plancher's Robotics Lab, co-supervised by Dr. James Anderson June 2024 - August 2024

- Created an algorithm serving as a universal platform for ensembled, federated deep reinforcement learning compatible with OpenAI Gymnasium environments and stable.baselines3 algorithms and applied it to micro UAVs
- Built physics-based RL simulations of crazyflie drones using Pybullet and gym with nonlinear aerodynamic effects incorporated and probabilistic domain randomization of environmental conditions such as wind and varying masses for more robust sim2real transfer
- Implemented a novel momentum-based federated RL algorithm, FEDSVRPG-M, in an ensembled fashion with other state-of-the-art algorithms to assess its benefits when synthesizing with actor and critic network aggregation

Oden Institute for Computational Engineering and Sciences

Austin, TX

ML Research Intern in Dr. Robert Moser's Predictive Computational Sciences Group

June 2023 - August 2023

- Post-processed simulation data through statistical and tensor analysis of complex isotropic and anisotropic homogeneous turbulence flows using mathematical/engineering theories regarding fast fourier transforms and spectrum analysis
- Analyzed statistical validation and uncertainty quantifications of large-scale, multidimensional data gathered from anisotropic turbulent flow simulations using python
- Established a new model of the dissipation term in the Reynolds Stress Evolution Equation by building deep learning models to find relationships between tensors which characterize the anisotropy of turbulent flows

Fermi National Accelerator Laboratory

Austin, TX

Undergraduate Researcher in Dr. Karol Lang's Particle Physics Group

August 2022 - May 2023

- Verified functionality of neutrino beam through a time series analysis of raw data from the Hadron Monitor which ensured validity of Fermilab's NOvA experiment
- Discovered new ways to implement particle physics theory in the computational visualization and analysis of data
- Coordinated with NOvA scientists and graduate students on a weekly basis to discuss analysis methods and results

Personal Projects

Deep Reinforcement Learning

December 2023 - May 2024

- Studied and implemented a state-of-the-art deep reinforcement learning algorithm named NeuralPMP under the supervision of Dr. Chandrajit Bajaj
- Reviewed the modern literature surrounding deep reinforcement learning algorithms and its applications, such as the distributional RL techniques used in AlphaGo and AlphaTensor
- Employed physics-informed dynamic learning with stochastic models of the Pontryagin Maximum Principle as well as deep learning to form a competitive RL algorithm

Gravitational Waves from Black Hole Mergers

January 2023 - May 2023

- Studied general and numerical relativity along with differential geometry with the UT Gravitational Physics group
- Utilized Einstein's field equations and the BSSN evolution equations to simulate a black hole merger and gather waveforms for the resulting gravitational waves emitted
- Analyzed data from LIGO to validate the simulated computational waveforms

Higgs Boson Particle Simulation

August 2022 - December 2022

- Implemented MadGraph software to simulate the 2012 CERN discovery of the Higgs Boson through 10 runs of 10,000 proton-proton collision events
- Studied quantum field theory and used Feynman diagrams to analyze simulation
- Utilized python to plot and correlate four-momenta of post-collision particles with respect to their event density and discovered the Higgs particle resonance peak

Awards

James W. Vick Endowed Presidential Scholarship in Natural Sciences

Summer 2024

Melvin J. Rieger Scholarship Fund in Physics

Summer 2024

Graham F. Carey Undergraduate Scholarship in Computational Science

Spring 2024

Nancy Francis and William McMinn Endowed Presidential Scholarship in Physics

Summer 2023

University Honors

August 2021 - Present