Yizhong Hu

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EDUCATION

Brown University **Sep 2020 – Ongoing**
Sc.B. Applied Mathematics – Computer Science, A.B Physics *Providence, Rhode Island*

EXPERIENCES

Undergraduate Research Assistant **May 2023 – Ongoing**
Brown University Division of Applied Mathematics *Providence, Rhode Island*

- Investigated *annealed pressure* of Spin Glass models on sparse random graphs. Advised by Prof. Kavita Ramanan of Brown Applied Mathematics
- Wrote numerical optimization to solve for a related optimization problem (Project Link)
- Proved that annealed pressure of certain discrete, pairwise models on random regular bipartite graphs is equivalent to the Bethe prediction through a cavity equation
- Made significant progress on continuous and non-pairwise interactions
- Honor's Thesis on the topic to be presented by Spring 2024
- Manuscript on the project to be published

Undergraduate Teaching Assistant **Aug 2023 – Dec 2023**
CSCI 1951X: Formal Proof and Verifications *Providence, Rhode Island*

- Helped develop a problem bank. Led office hours and labs. Graded homeworks. (Mid-semester Evaluation)

Undergraduate Research Assistant **Sep 2021 – Aug 2022**
Brown Particle Astrophysics *Providence, Rhode Island*

- Researched the ability of Reinforcement Learning algorithms to learn physics of their environments, with a goal of discovering RL algorithms' ability learn to strategize on a chaotic system
- Created a simulated 2D gravitational environment with a central $1/r$ potential, where a rocket agent can transfer between different orbits with its thrusters with NumPy and Matplotlib
- Reliably ($\sim 95\%$ success) trained Deep Q-Network agents with TensorFlow that, given position and velocity information, can form a circular orbit at a given radius, under $\sim 90\%$ of initial conditions and *discrete thrust* choices in the above game environment (Project Link)
- Devised an optimal control theory solution to the *continuous thrust* problem with Linear Quadratic Regulator (LQR)

PROJECTS

SINDy-PETS: A Flexible Physics-Informed and Probabilistic MBRL Architecture **May 2023**

- Devised a novel Model-Based Reinforcement Learning algorithm combining Symbolic Identification of Nonlinear Dynamics (SINDy) and Probabilistic Ensembles with Trajectory Sampling (PETS), called SINDy-PETS
- Proposed two methods of combination: Residual Correction and Opinion Input

Resonance in Bounded Driven Wave Equations **May 2022**

- Formulated the wave equation that is driven on one end by a delta external force
- Solved the equation to observe resonance behavior

Stably Rolling Square Wheel **Jun 2019**

- Formulated and solved a system of non-linear ODEs numerically (with Euler's Method) and analytically for a curved surface on which a square wheel can stably roll

RELATED COURSEWORK

- Applied ODEs, Applied PDEs
- Functions of Several Variables
- Information Theory
- Numerical Optimization
- Graph Theory
- Recent Applications of Probability and Statistics
- Machine Learning
- Reintegrating AI
- Quantum Mechanics, Statistical Mechanics

TECHNICAL SKILLS

Languages: Python, C, C++, LaTeX, Lean, Racket, Pyret, JavaScript
Developer Tools: VS Code, Linux, Git, GitHub
Libraries: Numpy, Scipy, Matplotlib, TensorFlow
Interests: Probability Theory, Optimization, Numerical Methods, Machine Learning, Dynamical systems and stability