Liang-Ying Chih

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Education

University of Colorado Boulder, Boulder, Colorado, USA — Aug 2017 – 2022 (expected)
PhD., Physics, GPA 3.96/4.00, Advised by Murray Holland

National Taiwan University, Taipei, Taiwan — Sep 2013 – Jun 2017
B.S., Physics, GPA 4.19/4.30

Research Experience

Graduate Research Assistant — Jan 2018 – Present
Theoretical Studies of Quantum Gases and Quantum Optics, JILA

Technical Skills

- Programming Languages: C++, MATLAB, Python (See my works at https://github.com/lilianchih)
- Expertise: Numerical Analysis, Reinforcement Learning, Optimization Methods, Monte Carlo Methods, Machine Learning
- Related Coursework: Numerical Analysis and Programming, Scientific Computing, Data Structures and Algorithms

Projects

Reinforcement-Learning-Improved Adiabatic Shortcuts for Quantum Systems (Python) — Jun 2021 – Present

- Model the effects of laser frequency noise and thermal fluctuations during quantum state preparation and mitigate the effects using adaptive adiabatic shortcuts. Evaluate the trade-off between time efficiency and noise robustness.
- Apply tabular Q-learning to control the adiabatic parameter in a system with Gaussian noise and reduce the infidelity of the quantum state by a factor of 5 while retaining efficiency.

Data reconstruction for satellite remote sensing images (Python) — Aug 2021 – Present

- Process and clean a 500GB satellite dataset into a format suitable for machine learning and statistical models.
- Apply random forest regression and long short-term memory models to reconstruct the missing data and compare the effectiveness with that of principal component analysis.

Control of a Quantum Inertial Sensor (Python/PyTorch/C++/MATLAB) — Aug 2019 – Present

- Model a compact inertial sensor based on quantum interferometry of atoms that measures acceleration in spacecraft. Collaborate with experimentalists and engineers to build the control system for an actual device.
- Apply deep reinforcement learning algorithms to control atoms in order to realize the desired quantum operations. Achieve 95% fidelity with an interrogation time shorter than what can be achieved by classical optimal control methods.
- Analyze simulated data using a Bayesian approach for the sensitivity of the sensor, and show that the machine-learned interferometer is 4 times more sensitive and covers a dynamic range that is 10 times larger than the conventional interferometer.
- Train, evaluate and tune the deep learning models on Google Cloud Platform with GPU acceleration to reduce model development time.

Neural Network Quantum States (C++/Eigen/Python/PyTorch) — Feb 2019 – May 2019

- Constructed a restricted Boltzmann machine to learn the distribution of a highly-entangled many-body quantum state. Trained the model using a dataset of 10,000 stochastic measurement results and achieved 98% fidelity.
- Discovered a low-dimensional representation for a highly-entangled many-body quantum state with an autoencoder model to reduce the dimensionality from 1024 to 2.
- Trained a recurrent neural network with 10,000 time-series data to predict the time evolution for a high-dimensional quantum state.

Selected Publications

- LY Chih, M Holland, Reinforcement-learning-based matter-wave interferometer in a shaken optical lattice, Physical Review Research **3**, 033279 (2021)
- LY Chih, M Holland, Driving quantum correlated atom-pairs from a Bose-Einstein condensate, New Journal of Physics **22**, 033010 (2020)

Honors and Awards

- Beverly Sears Graduate Student Research Award 2022 — Jan 2022
- 8th, 9th Annual Lucid Programming Competition, second place — Oct 2020, 2021
- Dean's Award of College of Science (graduated top 5% in class) — Jun 2017
- Chau-Ting Chang Undergraduate Research Scholarship — Dec 2015
- International Physics Olympiad Taiwan Finalist — Apr 2013