Reilly Raab

reilly@ucsc.edu | reillyraab.com | github.com/raabrp

Summary

PhD candidate in computer science with a strong mathematical background in physics and extensive programming experience implementing high-performance numerical simulations of multiagent systems, novel optimization techniques, and signal processing algorithms.

Skills

Machine Learning:	Kernel Methods, Adversarial Networks, Reinforcement Learning.
Optimization:	Convex Optimization, Evolutionary Game Theory, Approximate Newton Methods.
Programming:	GNU/Linux, Python, JavaScript, Lisp, C, Differentiable Programming, GPU Acceleration.

Education

PhD, Computer Science and Engineering — Fall 2019 – Winter 2024*
University of California, Santa Cruz — *Santa Cruz, CA*

- ARCS Scholar • Deans's Fellow • Regents Fellow • Dissertation Year Fellow • Advancement with Honors

BSc, Physics — Fall 2011 – Spring 2015
University of California, Santa Barbara (College of Creative Studies) — *Santa Barbara, CA*

- High Honors • Distinction in the Major • Education Abroad Scholarships

Experience

Graduate Student Researcher — Sept 2019 – Present
Human-Centered Machine Learning, UC Santa Cruz — *Santa Cruz, CA*

- Described dynamics of systems of mutual learners using evolutionary game theory [3].
- Established adversarial bounds for fairness violation due to distribution shift [4].
- Discovered exact, least-squares correspondence between replicator dynamics and natural gradient descent [5].
- Adapted online reinforcement learning methods to systems of mutually interacting learners [6].
- Mapped machine learning with policy-induced distribution shift to a novel constrained optimization algorithm [7].
- Wrote multi-agent simulations in Python using JAX and Taichi for GPU acceleration.

Software Developer — Oct 2016 – Aug 2018
Breadware, Inc. — *Reno, NV*

- Mapped abstract hardware APIs to I2C bus protocols for modular embedded devices (Python, C).
- Implemented web-based testing of user-logic for embedded devices in simulated environments (JavaScript).
- Wrote scripts for automating electronic design tasks, such as PCB layout (Python).

Teaching Assistant and Residential Mentor — Summer 2015 | Summer 2016
The Summer Science Program — *Socorro, NM | Boulder, CO*

- Mentored and supervised advanced high school students in observational astronomy.
- Graded written and programming assignments in celestial mechanics, programming, and mathematics.
- Wrote supplementary math and programming challenges and gave supplementary lectures.

Undergraduate Research Intern — Feb 2013 – Jun 2015
California NanoSystems Institute, UC Santa Barbara — *Santa Barbara, CA*

- Helped build universal Josephson junction superconducting quantum computers for Google Quantum AI.
- Calculated effect of hardware signal-chain imperfections on quantum gate error for software correction [2].
- Wrote software to automate phase-noise characterization of GHz oscillators (Python).

Undergraduate Research Intern — Jan 2011 – Jul 2011
UC Santa Barbara Center for Energy Efficient Materials — *Santa Barbara, CA*

- Worked on organic electric device characterization to develop plastic solar cells.
- Fit spectroscopic ellipsometry measurements to models for organic electron-donor molecules [1].
- Conducted laser-induced photoluminescence decay measurements for same electron-donor molecules [1].
- Performed atomic force microscopy measurements and statistical analyses for thin-layer morphology characterization.

*Anticipated

AWARDS

Dissertation Year Fellowship (Winter)	UC Santa Cruz	2024
Dissertation Year Fellowship (Fall)	UC Santa Cruz	2023
Best Paper Runner-Up [6]	RTML[†] Workshop at ICLR[‡]	2023
Highlighted Paper [6]	RTML Workshop at ICLR	2023
ARCS Scholar	ARCS Foundation, Inc., Northern California Chapter	2022
Advancement with Honors	UC Santa Cruz	2021
Spotlight Paper [3]	NeurIPS[§]	2021
Regents Fellowship	UC Santa Cruz	2019
Dean's Fellowship	UC Santa Cruz	2019
High Honors (BSc in Physics)	UC Santa Barbara	2015
Distinction in the Major (Physics)	UC Santa Barbara	2015
Education Abroad Scholarship	UC (All Campuses)	2013
Education Abroad Scholarship	UC Santa Barbara	2013
Undergraduate Research Internship	UCSB Center for Energy Efficent Materials	2011

PUBLICATIONS

[7] Fair Participation via Sequential Policies.
Reilly Raab, Ross Boczar, Maryam Fazel, and Yang Liu. *AAAI*, 2024.

[6] Long-Term Fairness with Unknown Dynamics.
Tongxin Yin[¶], **Reilly Raab**[¶], Mingyan Liu, and Yang Liu. *NeurIPS*, 2023.

[5] Conjugate Natural Selection.
Reilly Raab, Luca de Alfaro, and Yang Liu. *arXiv Preprint*, 2023.

[4] Fairness Transferability Subject to Bounded Distribution Shift.
Yatong Chen[¶], **Reilly Raab**[¶], and Yang Liu. *NeurIPS*, 2022.

[3] Unintended Selection: Persistent Qualification Rate Disparities and Interventions.
Reilly Raab and Yang Liu. *Neurips (Spotlight Paper)*, 2021.

[2] Single-Gate Error for Superconducting Qubits Imposed by Sideband Products of IQ Mixing.
Reilly P. Raab. *UC Santa Barbara Physics Department Website*, 2015.

[1] Systematic Study of Exciton Diffusion Length in Organic Semiconductors by Six Experimental Methods.
Jason Lin **et al**. *Materials Horizons*, 2014.

[†] Trustworthy and Reliable Large-Scale Machine Learning Models (RTML)
[‡] International Conference on Learning Representations (ICLR)
[§] Conference on Neural Information Processing Systems (NeurIPS)
[¶] Equal contribution