Chih-Fan (Rich) Pai

Ph.D. Candidate, UC San Diego

Electrical and Computer Engineering
cfrpai@gmail.com +1 (858) 531-9377 https://richpai.github.io

Research Interests

Sequential decision-making under uncertainty, with emphasis on online control and prediction for dynamical systems, online learning and optimization, and reinforcement learning.

Education

University of California, San Diego Sept. 2026 (Expected)
Ph.D., Electrical and Computer Engineering
J. Yang Scholarship

National Taiwan University 2020
M.S., Communication Engineering
Best Master's Thesis Award; Youth Thesis First Prize

National Yang Ming Chiao Tung University 2018
B.S., Electrical and Computer Engineering
Academic Excellence Award

Publications and Preprints

- **C.-F. Pai**, Y. Tang, and Y. Zheng. *Policy Optimization of Mixed $\mathcal{H}_2/\mathcal{H}_\infty$ Control: Benign Nonconvexity and Global Optimality*. Under review at *Automatica*.
- Y. Zheng, **C.-F. Pai**, and Y. Tang. *Benign Nonconvex Landscapes in Optimal and Robust Control, Parts I & II*. Under review at *IEEE Transactions on Automatic Control*.
- **C.-F. Pai**, X. Shang, J. Qian, and Y. Zheng. *Online Tracking with Predictions for Koopman-Linearizable Nonlinear Systems*. Learning for Dynamics and Control (L4DC), 2026.
- Y. Watanabe, **C.-F. Pai**, and Y. Zheng. *Semidefinite Programming Duality in Infinite-Horizon LQ Differential Games*. IEEE Conference on Decision and Control (CDC), 2025.
- Y. Zheng, **C.-F. Pai**, and Y. Tang. *Extended Convex Lifting for Policy Optimization of Optimal and Robust Control*. Learning for Dynamics and Control (L4DC), 2025.

Research Experience

University of California, San Diego 2023–Present
Research Assistant, Advisor: Professor Yang Zheng

- Developed online prediction algorithms for partially observed (marginally) stable linear dynamical systems under adversarial disturbances, achieving logarithmic regret with tailored predictive hints.
- Initiated a new research direction within the lab on adaptive regret minimization for online prediction and control under adversarial and/or nonstationary environments.
- Analyzed the dynamic regret of model predictive tracking algorithms for Koopman nonlinear systems.
- Established a new geometric and structural characterization of mixed $\mathcal{H}_2/\mathcal{H}_\infty$ control, proving benign nonconvexity and connecting policy optimization with classical Riccati theory and convex formulations.
- Developed Extended Convex Lifting, a unified framework revealing hidden convexity in nonconvex optimal and robust control, covering both state feedback static and output feedback dynamic policies.

National Taiwan University 2018–2020
Research Assistant, Advisor: Prof. See-May Phoong

- Conducted research in signal processing for communications, including time-varying channel estimation.

Selected Talks

- **Decision-making in Uncertain Dynamic Environments**
  Invited seminar, CS Department, National Yang Ming Chiao Tung University, Dec. 2025.
- **Online Non-stochastic Control: A Regret-Minimizing Approach**
  Invited presentation, DSC 291: Online Learning
  Host: Professor Yoav Freund, UC San Diego, March 2025.
- **Policy Optimization for Mixed Control: Benign Nonconvexity and Global Optimality**
  Southern California Control Workshop, University of Southern California, Nov. 2024.

Industry Experience

Qualcomm, Audio R&D Intern Summer 2025

- Designed adaptive active noise cancellation algorithms under real-time hardware constraints.
- Balanced convergence, robustness, and stability using optimization and robust control theory.

Teaching Experience

Teaching Assistant, UC San Diego

ECE 285: Agentic AI and LLMs for Smart Grids
ECE 228: Machine Learning for Physical Applications
ECE 285: Semidefinite and Sum-of-Squares Optimization
ECE 171A: Linear Control System Theory
ECE 101: Linear Systems Fundamentals

- Led discussion sessions and developed instructional materials.
- Received consistently strong student evaluations.

Teaching Assistant, National Taiwan University

Linear Algebra (EE), Calculus (MATH), Digital and Multi-rate Signal Processing (CommE)

Programming and Computational Tools

Python, MATLAB, C/C++; PyTorch, TensorFlow; NumPy, Pandas, scikit-learn.