

Jiachen Li

1620 West 6th Street, Austin | 858-305-1833 | jiachenli@utexas.edu | jiachenli2001.github.io

Education

The University of Texas at Austin , PhD in Dynamic Systems and Control GPA: 3.96/4.0, Advised by Prof. Dongmei Chen	2023.9 – 2027.6 (Expected)
Harbin Institute of Technology , BS in Control Engineering GPA: 3.7/4.0, Advised by Prof. Tong Wang, Prof. Jianbin Qiu, and Prof. Huijun Gao	2019.9 – 2023.7
University of California, San Diego , Academic Exchange Student	2022.9 – 2023.7

Research Interests

-
- **Robot Learning & Embodied AI:** Vision–language–action models, video reasoning, world models for robotics
 - **LLMs for Control:** Multi-agent LLM systems for automated controller synthesis, verification, and decision-making
 - **LLMs for Healthcare:** Agent-based ECG digitization and LLM-driven disease diagnosis
 - **Control & Optimization:** Data attribution for control, data-driven control, distributionally robust optimization, predict-then-control, model predictive control
 - **Robotics Planning & Safety:** Data-efficient trajectory planning, energy- and safety-aware planning, derivative-free trajectory optimization

Research Experience

Data-Driven Control, System Identification, and LLM Integration UT Austin, 2023–Present

- Developed the AURORA framework for autonomous online updating of reduced-order models and controllers via recursive adaptation, achieving stable tracking under model drift [P2]
- Integrated LLM agents with LMI-based synthesis to enable certified $\mathcal{H}_\infty$ controller design from natural-language specifications [P3, J4]
- Proposed predict-then-control methods that unify system identification and control through decision-regret minimization, reducing closed-loop cost compared to sequential identify-then-control baselines [P5]
- Applied influence functions for data attribution in linear system identification and LQR, enabling principled data selection that improves sample efficiency [P6]; extended robust data attribution with certified Wasserstein bounds from convex models to deep networks [P12]
- Developed MDR-DeePC, a model-inspired distributionally robust variant of Data-Enabled Predictive Control, improving robustness to noise and model mismatch [C2]
- Proposed datamodel-based and sensitivity-based data selection methods for nonlinear Data-Enabled Predictive Control for efficiency [P9, P10]
- Extended the Datamodels framework from supervised learning to Model Predictive Path Integral (MPPI) control, enabling efficient trajectory data valuation [P8, P4]

Battery-Aware Motion Planning for Autonomous Mobile Robots UT Austin, 2024–Present

- Formulated a joint task-scheduling and trajectory-planning optimization that co-optimizes energy efficiency and battery degradation, extending operational battery life [P1, C4]
- Developed a distributed coordination framework for real-time trajectory and task re-planning across multi-AMR fleets [P11]
- Addressed bilinear terms in the optimization via McCormick envelope relaxations, enabling tractable solutions with bounded optimality gaps [C3]

Roll-to-Roll Manufacturing Control UT Austin, 2024–Present

- Developed adaptive trajectory bundle methods for tension control in multi-section R2R systems, improving tracking accuracy over standard MPC [P7]
- Created an LLM-assisted multi-agent control framework that coordinates decentralized controllers for R2R process optimization [J4]

- Co-developed curriculum-based Soft Actor-Critic for multi-section R2R tension control, accelerating training convergence [J5, C1]

LLM Agents and Video Reasoning (Collaborative)

2025–Present

- Co-developed SkillsBench, the first benchmark for evaluating how structured procedural knowledge (Agent Skills) improves LLM agent performance across 86 tasks in 11 domains [P13]
- Contributed to the Very Big Video Reasoning (VBVR) suite, a large-scale dataset of 1M+ video clips across 200 reasoning tasks with a verifiable evaluation framework [P14]

Advanced Control Theory

Harbin Institute of Technology, 2020–2023

- Modeled collective dynamics of multi-agent systems as PDEs and proposed optimal containment-control protocols under input delay and spatial boundary communication [J1, C5]
- Developed adaptive fault-tolerant boundary control for scalar hyperbolic PDE systems with actuator faults [J2]
- Solved an open problem on stability region boundaries for linear fractional-order differential equations with delay; established a stability framework for fractional-order Hopfield neural networks with multiple time delays [J3]

Robotics and Computer Vision Applications

HIT & UCSD, 2021–2023

- Built an ECG digitization pipeline using learning-based methods and modeled the cardiovascular system for real-time bradycardia prediction via system identification; designed a wearable ECG device for differentiating hypertrophic cardiomyopathy from acquired left ventricular hypertrophy [P15]
- Designed an optimal stable-grasping strategy for a three-finger Plato hand in PyBullet simulation
- Introduced attention mechanisms into DnCNN for improved seismic data denoising

Publications

Journal Papers

- [J1] Hao Zhang, **Jiachen Li**, Tong Wang, Qingshuang Zeng, and Huaicheng Yan. “PDE-based event-triggered containment control of multi-agent systems with input delay under spatial boundary communication.” *International Journal of Robust and Nonlinear Control* 33, no. 2 (2023): 753–766.
- [J2] Runsheng Guo, **Jiachen Li**, Kangkang Sun, Tong Wang, and Jianbin Qiu. “Output-feedback boundary adaptive fault-tolerant control for scalar hyperbolic partial differential equation systems with actuator faults.” *International Journal of Adaptive Control and Signal Processing* 36, no. 11 (2022): 2716–2731.
- [J3] Zichen Yao, Zhanwen Yang, Yongqiang Fu, and **Jiachen Li**. “Asymptotical stability for fractional-order Hopfield neural networks with multiple time delays.” *Mathematical Methods in the Applied Sciences* 45, no. 16 (2022): 10052–10069.
- [J4] **Jiachen Li**, Shihao Li, Christopher Martin, Zijun Chen, Dongmei Chen, and Wei Li. “An LLM-Assisted Multi-Agent Control Framework for Roll-to-Roll Manufacturing Systems.” Accepted by NAMRC; recommended for fast-track to the *Journal of Manufacturing Systems (JMS)*.
- [J5] Shihao Li, **Jiachen Li**, Christopher Martin, Zijun Chen, Dongmei Chen, and Wei Li. “Curriculum-Based Soft Actor-Critic for Multi-Section R2R Tension Control.” Accepted by NAMRC / *Manufacturing Letters*.

Conference Papers (Accepted / Published)

- [C1] Christopher Martin, Shihao Li, **Jiachen Li**, Wei Li, and Dongmei Chen. “A Repetitive Learning Model Predictive Control Method for Nonlinear Systems with Application to Roll-to-Roll Manufacturing.” Accepted by ACC 2025.
- [C2] Shihao Li, **Jiachen Li**, Christopher Martin, Soovadeep Bakshi, and Dongmei Chen. “MDR-DeePC: Model-Inspired Distributionally Robust Data-Enabled Predictive Control.” Accepted by MECC 2025.
- [C3] **Jiachen Li**, Chu Jian, Feiyang Zhao, Shihao Li, Wei Li, and Dongmei Chen. “Robust Optimal Task Planning to Maximize Battery Life.” Accepted by MECC 2025.
- [C4] **Jiachen Li**, Chu Jian, Feiyang Zhao, Shihao Li, Wei Li, and Dongmei Chen. “Constrained Optimal Planning to Minimize Battery Degradation of Autonomous Mobile Robots.” Accepted as Oral, ICCRE 2025.
- [C5] Hao Zhang, **Jiachen Li**, Tong Wang, and Jianbin Qiu. “A Mixed Control Approach to Nonlinear Coupled Burgers’ PDE-ODE Systems with Sensor Nonlinearities.” In 2022 41st Chinese Control Conference (CCC), pp. 2525–2530.

Under Review / Preprints

- [P1] **Jiachen Li**, Chu Jian, Feiyang Zhao, Shihao Li, Wei Li, and Dongmei Chen. “Optimal Task Planning to Maximize Battery Life for Autonomous Mobile Robots.” Submitted to *Journal of Power Sources*.
- [P2] **Jiachen Li**, Shihao Li, and Dongmei Chen. “AURORA: Autonomous Updating of ROM and Controller via Recursive Adaptation.” arXiv:2511.07768. Submitted to L4DC 2025.

[P3] Shihao Li, **Jiachen Li**, Jiamin Xu, and Dongmei Chen. “From Natural Language to Certified H-infinity Controllers: Integrating LLM Agents with LMI-Based Synthesis.” arXiv:2511.07894. Submitted to L4DC 2025.

[P4] Shihao Li, **Jiachen Li**, Jiamin Xu, Christopher Martin, Wei Li, and Dongmei Chen. “Algorithm-Relative Trajectory Valuation in Policy Gradient Control.” arXiv:2511.07878. Submitted to L4DC 2025.

[P5] **Jiachen Li**, Shihao Li, and Dongmei Chen. “Smart Predict-Then-Control: Integrating Identification and Control via Decision Regret.” arXiv:2506.11279. Submitted to *IEEE Control Systems Letters*.

[P6] **Jiachen Li**, Shihao Li, Jiamin Xu, Soovadeep Bakshi, and Dongmei Chen. “Influence Functions for Data Attribution in Linear System Identification and LQR Control.” arXiv:2506.11293. Submitted to *IEEE Control Systems Letters*.

[P7] **Jiachen Li**, Shihao Li, Christopher Martin, Xu Duan, Wei Li, and Dongmei Chen. “Adaptive Trajectory Bundle Method for Roll-to-Roll Manufacturing Systems.” arXiv:2511.22954. Submitted to *IEEE/ASME Trans. Mechatronics / AIM* focused session.

[P8] **Jiachen Li**, Shihao Li, Xu Duan, and Dongmei Chen. “DM-MPPI: Datamodel for Efficient and Safe Model Predictive Path Integral Control.” arXiv:2512.00759(2025). Submitted to *IEEE Control Systems Letters*.

[P9] **Jiachen Li**, Shihao Li, and Dongmei Chen. “Datamodel-Based Data Selection for Nonlinear Data-Enabled Predictive Control.” arXiv:2512.00276(2025). Submitted to *IEEE Control Systems Letters*.

[P10] **Jiachen Li** and Shihao Li. “RDS-DeePC: Robust Data Selection for Data-Enabled Predictive Control via Sensitivity Score.” arXiv:2511.22952 (2025). Submitted to *IEEE Control Systems Letters*.

[P11] **Jiachen Li**, Shihao Li, Soovadeep Bakshi, and Dongmei Chen. “Real-Time Coordinated Battery-Conscious Motion and Task Planning for Multi-AMR Systems.” (2025).

[P12] Shihao Li, **Jiachen Li**, and Dongmei Chen. “Natural Geometry of Robust Data Attribution: From Convex Models to Deep Networks.” arXiv:2512.09103 (2025).

[P13] Xiangyi Li, Wenbo Chen, . . . , **Jiachen Li**, . . . , Steven Dillmann, and Han-chung Lee. “SkillsBench: Benchmarking How Well Agent Skills Work Across Diverse Tasks.” arXiv:2602.12670 (2026). (Submitted to ICML)

[P14] Maijunxian Wang, Ruisi Wang, . . . , **Jiachen Li**, . . . , Hokin Deng. “A Very Big Video Reasoning Suite.” arXiv:2602.20159 (2026). (Submitted to ICML)

[P15] **Jiachen Li**, Edward Kim, Hanyu Zhu, Shihao Li, Dongmei Chen, and Wei Li. “A Wearable ECG Device for Differentiating Hypertrophic Cardiomyopathy from Acquired Left Ventricular Hypertrophy.” Submitted to *Journal of Medical Devices*.

Technical Skills

Programming: Python, C++, MATLAB/Simulink, LabVIEW

ML / Optimization: PyTorch, TensorFlow, CasADi, CVXPY, Gurobi

Robotics / Simulation: ROS, PyBullet, Gazebo

Methods: Model Predictive Control (MPC), LMI-based synthesis, convex/nonconvex optimization, reinforcement learning, system identification, data-driven control

Tools: Git, L^AT_EX, Docker, Linux

Awards & Honors

Professional Development Award , UT Austin Graduate School — competitive travel/research grant for doctoral students	2025
School of Engineering (SoE) Fellowship , UT Austin — merit-based fellowship for incoming PhD students	2023
First Prize , National College Competition on Internet of Things — top tier among 10,000+ teams nationwide	2022
Second Prize , National College Electronics Design Contest	2021
First Prize , National College Competition on Mathematics	2020
First-Class Scholarship , Harbin Institute of Technology — awarded to top 5% of students	2020