FANGYU WU

Postdoctoral Fellow in AI, Operations, and Robotics
Columbia University

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Field of Specialization

I work at the intersection of **AI, operations, and robotics**, with a particular focus on multi-agent systems. My research explores how foundation models, control theory, and combinatorial optimization can enable more capable autonomous systems. Applications include **autonomous driving, robot manipulation, and AI agents**.

Keywords: Multi-Agent Systems, World Models, VLA Models, Autonomous Driving, AI Agents, Optimal Control, Motion Planning, Mechatronics

Education

2018 – 2024 **University of California, Berkeley** *Berkeley, CA*
Ph.D. + M.Eng. in Electrical Engineering and Computer Sciences
Concentration: Control, Intelligent Systems, and Robotics
Advisor: Alexandre Bayen
Dissertation: *On Planning and Control for Multi-Agent Robotic Systems*

2012 – 2018 **University of Illinois at Urbana-Champaign** *Urbana, IL*
M.S. + B.S. in Systems Engineering, CEE (with highest honors)
Minor in Computer Science and Architecture

Academic Experience

2025 – *present* **Columbia University** *New York, NY*
Decision, Risk and Operations Division
Postdoctoral Fellow

- Develop **continuous language models** in latent space using a novel **diffusion + recurrent** architecture; manage pre-training on **multi-node GPU clusters**; apply novel test-time steering using MPC.
- Trained **VLA and imitation policies** (π_0, $\pi_{0.5}$, SmolVLA, Diffusion Policy, and ACT) for ALOHA manipulation; collected demonstrations and ran sim-to-real experiments for Interactive World Simulator, an **action-conditioned world model** (RSS 2026 [C3]).
- Built a **high-fidelity simulator** of KNAPP warehouses; used coding agents for multi-robot policy search, achieving **58.9% higher simulated throughput** than the calibrated baseline on a 65-robot layout, with one policy across six facilities (TMLR [J2], under review).
- Contributed to **LLM benchmarks** for continual learning and general-purpose AI agents (NeurIPS 2026 [C2]; ICLR [C1], under review).

2024 – 2025 **Cornell University** *Ithaca, NY*
Electrical and Computer Engineering
Postdoctoral Associate

- Developed mixed-integer and statistical models for joint **powertrain selection and battery sizing** to minimize lifecycle emissions. Assessed grid and shared-vehicle scenarios with year-long U.S. and Chinese travel data. Manuscript in preparation for submission to Nature Energy.
- Researched shortest-path planning under distributional uncertainty, using Wasserstein **distributionally robust optimization** and a least-regret criterion.
- Coordinated with researchers and stakeholders on an autonomous vehicle initiative in Tulsa, involving MetroLink Tulsa, MIT, NREL, the U.S. Department of Energy, and industry partners.

2018 – 2024 **University of California, Berkeley** *Berkeley, CA*

Berkeley Artificial Intelligence Research
Research Assistant

- Developed **hierarchical MPC** for car-following via linearly constrained quadratic programming, using traffic data to attenuate stop-and-go waves (L-CSS 2023 [J8]).
- Combined MPC, LQR, and neural network controllers to **reduce computational cost** while **preserving stability** for nonlinear systems (T-ASE 2024 [J7]).
- Built the **Berkeley DeepDrive Drone Dataset** with over 20 hours of aerial video, curated training images, and trained vehicle detectors; developed **consensus-based models** for decentralized coordination on understructured roads (ICRA 2025 [C4]).
- Customized Toyota RAV4 and Cadillac XT5 for **CAN bus drive-by-wire** cruise control using `ROS`, Comma AI Panda Black, and Intrepid neoVI FIRE 2 for Interstate 24 experiments (RA-L 2024 [J4]; CSM 2025 [J3]; T-RO 2024 [J6]).

2016 – 2018 **University of Illinois at Urbana-Champaign** *Urbana, IL*

Coordinated Science Laboratory
Research Assistant

- Designed **physics-informed neural networks** for car-following models; showed improved generalization and reproduction of stop-and-go waves over generic networks in microscopic traffic simulations (ITSC 2018 [C9]).
- Built a panoramic camera system and computer vision pipeline for **vehicle tracking with single-pixel accuracy**, enabling analysis of traffic oscillations and fuel consumption in field experiments (TR-C 2019 [J10]; TRB 2017 [C10]).
- Designed **sensor-fusion** algorithms for traffic monitoring, combining **cameras with thermal and ultrasonic sensors** to estimate vehicle speeds.

Professional Experience

2023 **NVIDIA** *Santa Clara, CA*

Research Intern

- Developed MPC cost functions for longitudinal trajectory planning in adaptive cruise control, drawing on **sliding mode control** and **control barrier functions**. The design supports safe deceleration and acceleration when nearby vehicles cut in.
- Calibrated MPC controllers in simulation and on test vehicles; contributed adaptive cruise control software to NVIDIA DRIVE AV for Mercedes-Benz production vehicles.

2018 **Intel** *Shanghai, China*

Research Intern

- Accelerated `TensorFlow` and `Caffe` workloads using **model quantization** on Intel Xeon CPUs for computer vision and **deep RL** applications, including an advanced Go-playing policy.
- Presented machine learning methods and applications to the engineering team; materials were retained as an internal reference for employee training.

Selected Awards and Honors

2026 Best Student Paper Award, RSS Robot World Models Workshop

2025 Pikarsky Best Dissertation Award, CUTC

2024 Eli Jury Award, UC Berkeley, EECS

2024 Outstanding Graduate Student Instructor, UC Berkeley, EECS

2020 Best Paper Award, TR-C

2019 Departmental Fellowship, UC Berkeley, EECS

2018 Dwight David Eisenhower Fellow, US DOT

Journal Papers

* Grey entries are under review

*J1. T. Yen, G. Yang, N. Ye, M. Chen, D. Xia, T. Shen, Y. Jeon, Y. Chen, D. Mittal, F. Wu, and H. Namkoong, "Seq@K: Evaluating language models under sequential feedback." Under review at *Data-centric Machine Learning Research (DMLR)*, 2026.

*J2. M. Eder, P. Emmanouil, V. Farias, F. Fischer, A. Jozefiak, T. Peng, T. Ulz, R. Watschinger, F. Wu (lead author), and A. Zheng, "Policy search in code space for multi-agent pathfinding." Under review at *Transactions on Machine Learning Research (TMLR)*, 2026. (Authors listed alphabetically by last name)

J3. J. W. Lee, H. Wang, K. Jang, N. Lichtlé, A. Hayat, (F. Wu among 54 coauthors), B. Seibold, J. Sprinkle, B. Piccoli, M. L. Delle Monache, A. M. Bayen, "Traffic control via connected and automated vehicles: An open-road field experiment with 100 CAVs," *IEEE Control Systems Magazine (CSM)*, 2025.

J4. F. Wu, J. Carpio, M. Bunting, M. Nice, D. Work, J. Sprinkle, J. Lee, S. Hornstein, and A. Bayen, "Modifying adaptive cruise control systems for string stable stop-and-go wave control," *IEEE Robotics and Automation Letters (RA-L)*, 2024.

J5. M. S. Chauhan, A. Chauhan, M. Bayen, F. Wu, F. A. Althukair, M. T. Kaiser, and L. F. Jacobs, "eNut: A sensing system to measure the acquisition of foraging proficiency in wild tree squirrels," *IEEE Sensors Journal (JSEN)*, 2024.

J6. N. Lichtlé, E. Vinitsky, M. Nice, R. Bhadani, M. Bunting, F. Wu, B. Piccoli, B. Seibold, D. Work, J. Lee, J. Sprinkle, and A. Bayen, "From sim to real: A pipeline for training and deploying traffic smoothing cruise controllers," *IEEE Transactions on Robotics (T-RO)*, 2024.

J7. F. Wu, G. Wang, S. Zhuang, K. Wang, A. Keimer, I. Stoica, and A. Bayen, "Composing MPC with LQR and neural network for amortized efficiency and stable control," *IEEE Transactions on Automation Science and Engineering (T-ASE)*, 2024.

J8. F. Wu and A. M. Bayen, "A hierarchical MPC approach to car-following via linearly constrained quadratic programming," *IEEE Control Systems Letters (L-CSS)*, vol. 7, pp. 532–537, 2023.

J9. R. E. Stern, Y. Chen, M. Churchill, F. Wu, M. L. Delle Monache, B. Piccoli, B. Seibold, J. Sprinkle, and D. Work, "Quantifying air quality benefits resulting from few autonomous vehicles stabilizing traffic," *Transportation Research Part D: Transport and Environment (TR-D)*, vol. 67, pp. 351–365, 2019.

J10. F. Wu, R. E. Stern, S. Cui, M. L. Delle Monache, R. Bhadani, M. Bunting, M. Churchill, N. Hamilton, B. Piccoli, B. Seibold, J. Sprinkle, and D. Work, "Tracking vehicle trajectories and fuel rates in phantom traffic jams: Methodology and data," *Transportation Research Part C: Emerging Technologies (TR-C)*, vol. 99, pp. 82–109, 2019.

J11. R. E. Stern, S. Cui, M. L. Delle Monache, R. Bhadani, M. Bunting, M. Churchill, N. Hamilton, H. Pohlmann, F. Wu, B. Piccoli, B. Seibold, J. Sprinkle, and D. Work, "Dissipation of stop-and-go waves via control of autonomous vehicles: Field experiments," *Transportation Research Part C: Emerging Technologies (TR-C)*, vol. 89, pp. 205–221, 2018.

Conference Proceedings

* Grey entries are under review

*C1. D. Mittal, T. Castellani, T. Yen, N. Ye, M. Chen, T. Cai, E. Koukoumidis, W. Zeng, F. Wu, and H. Namkoong, "LatentGym: A testbed for cross-task experiential learning with controllable latent structure." Under review at *International Conference on Learning Representations (ICLR)*, 2026.

C2. Y. Sun, X. Han, W. Zhang, X. Liu, Y. Pang, (F. Wu among 347 coauthors), X. Li, X. Li, B. You, W. Ke, D. Song, "Agents' Last Exam," in *Conference on Neural Information Processing Systems (NeurIPS)*, 2026.

C3. Y. Wang, R. Syed, F. Wu, M. Zhang, A. Onol, J. Barreiros, H. Nayyeri, T. Dear, H. Zhang, and Y. Li, "Interactive world simulator for robot policy training and evaluation," in *Robotics: Science and Systems (RSS)*, 2026.

C4. F. Wu, D. Wang, M. Hwang, C. Hao, J. Lu, J. Zhang, C. Chou, T. Darrell, and A. Bayen, "Decentralized vehicle coordination: The Berkeley DeepDrive Drone Dataset and consensus-based models," in *IEEE International Conference on Robotics and Automation (ICRA)*, 2025.

C5. X. Wang, M. Nice, M. Bunting, F. Wu, M. L. Delle Monache, J. Lee, B. Piccoli, B. Seibold, A. Bayen, D. Work, and J. Sprinkle, "Human-in-the-loop classification of adaptive cruise control at a freeway scale," in *ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS)*, 2025.

C6. R. Bhadani, M. Bunting, M. Nice, F. Wu, A. Hayat, J. W. Lee, A. Bayen, B. Piccoli, B. Seibold, D. Work, and J. Sprinkle, "Approaches for synthesis and deployment of controller models on automated vehicles for car-following in mixed autonomy," in *Proceedings of Cyber-Physical Systems and Internet of Things Week 2023*, pp. 158–163, 2023.

C7. T. Cabannes, J. Li, F. Wu, H. Dong, and A. M. Bayen, "Learning optimal traffic routing behaviors using Markovian framework in microscopic simulation," in *Transportation Research Board Annual Meeting (TRB)*, 2020.

C8. E. Vinitsky, A. Kreidieh, L. Le Flem, N. Kheterpal, K. Jang, C. Wu, F. Wu, R. Liaw, E. Liang, and A. Bayen, "Benchmarks for reinforcement learning in mixed-autonomy traffic," in *Conference on Robot Learning (CoRL)*, pp. 399–409, PMLR, 2018.

C9. F. Wu and D. Work, "Connections between classical car following models and artificial neural networks," in *IEEE International Conference on Intelligent Transportation Systems (ITSC)*, pp. 3191–3198, IEEE, 2018.

C10. F. Wu, R. Stern, M. Churchill, M. L. Delle Monache, K. Han, B. Piccoli, and D. Work, "Measuring trajectories and fuel consumption in oscillatory traffic: Experimental results," in *Transportation Research Board Annual Meeting (TRB)*, p. 14, 2017.

Invited Talks

T1. "Efficient optimization of autonomous agents with differentiable language models." INFORMS, Recent advances in data-driven decision-making, 2026.

T2. "Can language models dream in continuous thought?" Columbia, DRO, 2026.

T3. "Control of multi-agent dynamical systems with applications to mixed-autonomy transportation." Columbia, CEEM, 2025.

T4. "Learning to accelerate: A method for speeding up costly computation." Amazon, New York, 2025.

T5. "Control of multi-agent dynamical systems with applications to mixed-autonomy transportation." HKU, DASE, 2025.

T6. "Introduction to connected and automated vehicles and field experiments." Cornell, CEE, 2025.

T7. "Control of multi-agent dynamical systems in understructured and hyperstructured environments." Columbia, DRO, 2025.

T8. "Control of multi-agent dynamical systems with applications to mixed-autonomy transportation." U. Washington, CEE, 2025.

T9. "From distributed control to centralized optimization: Charting the next decades of autonomous driving." Cornell, Info. and Decision Sci. Lab, 2024.

T10. "From distributed control to centralized optimization: Charting the next decades of autonomous driving." Caltech, AMBER Lab, 2023.

T11. "An MPC approach to longitudinal trajectory planning." NVIDIA, Autonomous Driving, 2023.

T12. "Motion planning in understructured road environments with stacked reservation grids." ICRA Workshop on Perception, Action, Learning, 2020.

T13. "Navigating through chaos: Planning with stacked reservation grid."
Berkeley DeepDrive Virtual Workshop, 2020.

T14. "An open robotics platform for multiagent learning and control." CPS PI Meeting, 2019.

T15. "Connections between car-following models and neural networks." ITSC, 2018.

T16. "A tutorial on simulation of urban mobility." ITSC, 2018.

T17. "Hybrid microscopic traffic modeling using a classic car following model and a corrective neural noise model." Dwight David Eisenhower Transportation Fellowship Program Research Showcase, 2018.

T18. "Fuel consumption in oscillatory traffic: Experimental results." TRB Annual Meeting, 2017.

Teaching Experience

2023 **EECS 106B: Robotic Manipulation and Interaction** *UC Berkeley*
Electrical Engineering and Computer Sciences
Teaching Assistant

- Designed a ground-robot lab on dead reckoning, Kalman filtering, and extended Kalman filtering; supervised team projects in motion planning, estimation, and control.
- Student evaluation: 4.76/5 (department average: 4.61/5; scores normalized for comparison).

2021 **EECS 106A: Introduction to Robotics** *UC Berkeley*
Electrical Engineering and Computer Sciences
Teaching Assistant

- Led weekly labs using `ROS` with the Baxter bimanual robot and TurtleBot in a course with over 200 students; redesigned assignments for in-person instruction and held office hours.
- Student evaluation: 4.50/5 (department average: 4.25/5).

2019 – 2020 **ENGIN 296MA: Capstone Project** *UC Berkeley*
Electrical Engineering and Computer Sciences
Ph.D. Mentor

- Established a mechatronics lab and mentored five M.Eng. students through a year-long capstone covering CAD, PCB design, and 3D printing.
- Guided development of an open-source, low-cost testbed of unicycle and bicycle robots; presented the work at the 2019 Cyber-Physical Systems Principal Investigators' Meeting.

2016 **CEE 498SIS: Sustainable and Resilient Infrastructure Systems** *UIUC*
Civil and Environmental Engineering
Teaching Assistant

- Participated in designing a graduate course on large-scale civil infrastructure systems using linear programming and ODE modeling; led weekly office hours.
- Student evaluation: 4.80/5 (highest recorded for the course).

Service and Mentorship

Peer Reviews

2026 IEEE International Conference on Robotics and Automation (ICRA)

2025 IEEE Transactions on Control Systems Technology (TCST); IEEE Transactions on Intelligent Transportation Systems (T-ITS); Transportation Research Part C: Emerging Technologies (TR-C)

2024 Automatica; IEEE International Conference on Robotics and Automation (ICRA); IEEE Robotics and Automation Letters (RA-L)

2023 IEEE Conference on Decision and Control (CDC); IEEE Intelligent Vehicles Symposium (IV); IEEE Robotics and Automation Letters (RA-L); IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS); Nonlinear Analysis: Hybrid Systems (NAHS)

2022 Workshop on Data-Driven and Intelligent Cyber-Physical Systems for Smart Cities (DI-CPS)

2019 IEEE International Conference on Intelligent Transportation Systems (ITSC); IEEE Transactions on Intelligent Transportation Systems (T-ITS)

2018 IEEE International Conference on Intelligent Transportation Systems (ITSC)

Research Mentorship

2026 – *present* Ziyu Huang (MS in Data Science, Columbia)

2025 – *present* Jonathan Wang (BS in Computer Science, Columbia)

2024 – 2025 Zhaoxuan Hu (PhD in Systems Engineering, Cornell) → Engineer, Meta

2022 – 2024 Jiamu Zhang (BS in EECS, UC Berkeley) → MS, CMU

2022 Avikam Chauhan (BS in EECS, UC Berkeley) → MS, UC Berkeley

2022 Fahd Althukair (BS in EECS, UC Berkeley) → Engineer, Aramco

2020 – 2022 Minjune Hwang (BS in EECS, UC Berkeley) → MS, Stanford

2020 – 2021 Chenhui Hao (MS in CEE, UC Berkeley) → Algorithm Engineer, Meituan

2020 – 2021 Jiawei Lu (BS in Physics, Nanjing University) → MS, Columbia

2019 – 2021 Jiayi Li (BS in EECS, UC Berkeley) → PhD, University of Washington

2019 Kehan Wang (BS in EECS, UC Berkeley) → Software Engineer, Google

2019 Nathan Lichtlé (MS in CS, ENS Paris-Saclay) → PhD, UC Berkeley

Club Advising

2021 – 2023 **Robot Open Autonomous Racing** *UC Berkeley*

- Advised a student club team on motion planning and state estimation for autonomous racing, supporting hands-on prototyping and vehicle tests.
- The team placed second at the 2022 Indy Autonomous Challenge at Texas Motor Speedway and third at the 2023 Autonomous Challenge at the Consumer Electronics Show in Las Vegas.

2017 **Illinois Geometry Laboratory** *UIUC*

- Advised hands-on student club projects in embedded deep learning on NVIDIA Jetson, including prototypes for facial and license plate recognition.
- Built a shared multi-GPU server for 30 student researchers.

Community Outreach

2020 – 2024 Berkeley Artificial Intelligence Research Mentor, UC Berkeley

2023 Faculty Candidate Interview Student Committee Chair, UC Berkeley

2023 Equal Access to Application Assistance Mentor, UC Berkeley

2020 K–12 Science Outreach, École Bilingue de Berkeley