FANGYU WU

Postdoctoral Associate in Robotics and Autonomy, ECE, Cornell
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SUMMARY

My research interests reside at the intersection of **embodied intelligence**, **robotics automation**, and **environmental sustainability**. I have published 16 papers, accumulating over 1,200 citations in leading control, robotics, and transportation journals and conferences, with 9 of these as the first author. At heart, I am a roboticist with a deep passion for research in automated vehicles, unmanned aerial vehicles, and bipedal/quadrupedal robots.

EDUCATION

University of California, Berkeley — Berkeley, CA
Ph.D. in Electrical Engineering and Computer Sciences — Aug. 2019 – Jul. 2024
Concentration in Control, Intelligent Systems, and Robotics

University of California, Berkeley — Berkeley, CA
M.Eng. in Electrical Engineering and Computer Sciences — Aug. 2018 – May 2019
Concentration in Control, Intelligent Systems, and Robotics

University of Illinois at Urbana-Champaign — Urbana, IL
M.S. in Civil and Environmental Engineering — Jan. 2016 – May 2018
Concentration in Sustainable and Resilient Infrastructure Systems

University of Illinois at Urbana-Champaign — Urbana, IL
B.S. in Civil and Environmental Engineering — Aug. 2012 – Dec. 2015
Concentration in Sustainable and Resilient Infrastructure Systems
Minors in Computer Science and Architecture

AWARDS AND HONORS

1. Outstanding Graduate Student of the Year, Berkeley ITS, 2024
2. Eli Jury Award, UC Berkeley Dept of EECS, 2024
3. Outstanding Graduate Student Instructor, UC Berkeley Dept of EECS, 2024
4. Best Paper Award, Transportation Research Part C: Emerging Technologies, 2020
5. Sevin Rosen Funds Award, UC Berkeley Dept of EECS, 2019
6. Dwight David Eisenhower Fellow, US DoT, 2017 – 2018
7. Road Safety Fellow, Collaborative Sciences Center for Road Safety, 2018
8. Fung Excellence Scholarship, UC Berkeley College of Engineering, 2018
9. Graduated with Highest Honors, UIUC, 2015
10. Grant W. Shaw Memorial Scholarship, UIUC College of Engineering, 2015

LEAD PROPOSAL WRITER

1. **Berkeley Deep Drive**, $15,000, 2023
2. **Berkeley Deep Drive / General Motors**, $80,000, 2021
3. **Berkeley Deep Drive**, $40,000, 2019

RESEARCH EXPERIENCE

Cornell ECE Ithaca, NY
Postdoctoral Associate Jul. 2024 – *present*

- Developing simultaneous routing and planning methods for electric and autonomous vehicles over networks.
- Coordinating with collaborators from MetroLink Tulsa, MIT, the National Renewable Energy Laboratory, the U.S. Department of Energy, and industry parterners on an autonomous transit project in Tulsa, OK.
- Developing research projects and writing proposals on robust quadrupedal robot control for applications in construction management, ecological survey, and environmental science.

Berkeley AI Research & Berkeley DeepDrive Berkeley, CA
Research Assistant Aug. 2018 – May 2024

- Developed model predictive control methods for multiagent path planning and autonomous vehicle control. The results are published to IEEE L-CSS and IEEE T-ASE.
- Built a dataset named Berkeley DeepDrive Drone Dataset, which consists of over 20 hours of videos on understructured road environments. The preliminary results appeared in an ICRA workshop in 2020. The latest work is submitted to the 2025 International Conference on Robotics and Automation.
- Reconfigured a Toyota RAV4 for autonomous cruise control via Comma AI Panda Black and ROS. The vehicle participated in several field experiments in Richmond, CA and on Interstate 24 in Nashville, TN since 2021.
- Customized a Cadillac XT5 for custom adaptive cruise control via Intrepid neoVI FIRE 2 and ROS. The customized vehicle was tested on Interstate 24 in Nashville, TN in November of 2022.

Coordinated Science Laboratory Berkeley, CA
Research Assistant Jan. 2016 – May 2018

- Built a hybrid traffic microsimulation model through combining established ODE models and feedforward neural networks for more realistic traffic microsimulation. The result is published in the IEEE ITSC 2018.
- Developed unsupervised vision algorithms to track vehicles in panoramic scenes within single pixel accuracy. The work led to two journal papers in TR-C, one journal paper in TR-D, and one conference article in TRB, two of which I first authored.
- Designed speed estimation algorithms through sensor fusing from cameras, thermal sensors, and ultrasonic sensors. The results were in submission to IEEE Transactions on ITS, which I had a shared second authorship.

PUBLICATIONS

JOURNAL PAPERS

1. **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*, 2024

2. 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*, 2024

3. J. Lee, H. Wang, K. Jang, A. Hayat, M. Bunting, A. Alanqary, W. Barbour, Z. Fu, X. Gong, G. Gunter, S. Hornstein, A. R. Kreidieh, N. Lichtlé, M. Nice, W. Richardson, A. Shah, E. Vinitsky, **F. Wu**, S. Xiang, S. Almatrudi, F. Althukair, R. Bhadani, J. Carpio, R. Chekroun, E. Cheng, M. T. Chiri, F.-C. Chou, R. DeLorenzo, M. Gibson, D. Gloudemans, A. Gollakota, J. Ji, A. Keimer, N. Khoudari, M. Mahmood, M. Mahmood, H. Matin, S. McQuade, R. Ramadan, D. Urieli, X. Wang, Y. Wang, R. Xu, M. Yao, Y. You, Z. Gergely, Y. Zhao, M. Ameli, N. Baig, S. Bhaskaran, K. Butts, M. Gowda, C. Janssen, J. Lee, L. Pedersen, R. Wagner, Z. Zhang, C. Zhou, D. Work, B. Seibold, J. Sprinkle, B. Piccoli, M. L. Delle Monache, and A. Bayen, "Traffic control via connected and automated vehicles: An open-road field experiment with 100 cavs," *IEEE Control Systems Magazine*, 2024

4. 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*, 2024

5. **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*, 2023

6. **F. Wu** and A. M. Bayen, "A hierarchical mpc approach to car-following via linearly constrained quadratic programming," *IEEE Control Systems Letters*, vol. 7, pp. 532–537, 2022

7. 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*, vol. 67, pp. 351–365, 2019

8. **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*, vol. 99, pp. 82–109, 2019

9. 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*, vol. 89, pp. 205–221, 2018

CONFERENCE AND WORKSHOP PAPERS

1. **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." <u>submitted to</u> *IEEE International Conference on Robotics and Automation*, 2024

2. 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

3. **F. Wu**, D. Wang, M. Hwang, C. Hao, J. Lu, T. Darrell, and A. Bayen, "Motion planning in understructured road environments with stacked reservation grids," in *ICRA Workshop on Perception, Action, Learning*, 2020

4. 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 Review Board Annual Meeting 2020*, 2020

5. 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*, pp. 399–409, PMLR, 2018

6. **F. Wu** and D. Work, "Connections between classical car following models and artificial neural networks," in *2018 21st International Conference on Intelligent Transportation Systems*, pp. 3191–3198, IEEE, 2018

7. **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 96th Annual Meeting*, p. 14, 2017

TEACHING EXPERIENCE

Courses

CEE 4655: Modeling and Optimization for Smart Infrastructure Systems   Cornell University
Guest Lecturer   Oct. 2024

- Delivered a guest lecture on the topics of gradient descent, log barrier functions, and KKT conditions to a group of approximately 25 senior undergraduate students.

EECS 106B: Robotic Manipulation and Interaction   UC Berkeley
Laboratory Teaching Assistant   Jan. 2023 – May 2023

- Designed a novel lab assignment centered around estimation methods for ground robots, including dead-reckoning, Kalman filter, and extended Kalman filter. Held weekly literature review and office hours, and supervised teams in final project on motion planning, state estimation, and control.

- The teaching received excellent student evaluation of 6.66/7.0, above the departmental average of 6.45/7.0.

EECS 106A: Introduction to Robotics
Laboratory Teaching Assistant

UC Berkeley
Aug. 2021 – Dec. 2021

- Transitioned lab assignments from a virtual format, implemented during COVID, to an enhanced in-person format. Held weekly lab sessions and office hours, and prepared presentations and exams for a class of over 200 graduate and undergraduate students.
- The teaching received excellent student evaluation of 4.50/5.0, above the departmental average of 4.25/5.0.

ENGIN 296MA: Capstone Project
Ph.D. Mentor

UC Berkeley
Aug. 2019 – May 2020

- Built a mechatronic lab and mentored a team of five graduate students in a one-year M.Eng. capstone project program. Led the team to develop an open-source, low-cost hardware testbed consisting of 3D-printed unicycle and bicycle robots.
- The results were presented in the 2019 Cyber Physical Systems Principal Investigators' Meeting.

CEE 498SIS: Sustainable Infrastructure Systems
Teaching Assistant

UIUC
Jan. 2016 – May 2016

- Assisted in the design of a graduate course at UIUC that teaches analysis of large-scale civil infrastructure systems. Held weekly office hours answering questions about homework and lectures.
- The teaching received excellent student evaluation of 4.8/5.0, the highest since the establishment of the course.

Mentorship

- Jiamu Zhang, EECS, 2022 – 2024: currently master's student at Carnegie Mellon University
- Avikam Chauhan, EECS, 2022: currently master's student at University of California, Berkeley
- Fahd Althukair, EECS, 2022: currently engineer at Aramco
- Minjune Hwang, EECS, 2020 – 2022: currently master's student at Stanford University
- Chenhui Hao, CEE, 2020 – 2021: currently agorithm engineer at Meituan
- Jiawei Lu, Physics, 2020 – 2021: currently master's student at Columbia University
- Jiayi Li, EECS, 2019 – 2021: currently doctoral student at University of Washington
- Kehan Wang, EECS, 2019 – 2020: currently software engineer at Google
- Nathan Lichtlé, EECS, 2019: currently doctoral student at University of California, Berkeley

INDUSTRY EXPERIENCE

NVIDIA
Optimization Intern

Santa Clara, CA
May 2023 – Aug. 2023

- Developed a novel predictive control cost via principles of sliding mode control and control barrier function. This new design ensures safe adaptive cruise control in events of cut-ins.
- Conducted extensive calibration of model predictive controllers to optimize longitudinal trajectories in both simulations and real-world deployment. The resulting controller is scheduled for integration into the adaptive cruise control systems of Mercedes-Benz in 2024.

Intel
Machine Learning Intern

Shanghai, China
Jan. 2018 – Apr. 2018

- Optimized clients' computer vision and deep reinforcement learning applications in TensorFlow and Caffe on Intel Xeon CPUs. One of the projects has enabled our client to build a go model that defeated the world champion Jun. ghwan Park in the Alibaba 2050 Conference with Intel-only CPUs.
- Presented weekly to the project manager and team members about machine learning theories and applications. The presentation slides were kept as an internal reference by the team for future employee training.

INVITED TALKS

1. **F. Wu**, "From distributed control to centralized optimization: Charting next decades of autonomous driving," *AMBER Lab, California Institute of Technology*, Sep 2023

2. **F. Wu**, "A model predictive control approach to longitudinal trajectory planning," *Autonomous Driving Division, NVIDIA*, Aug 2023

3. **F. Wu**, D. Wang, M. Hwang, C. Hao, J. Lu, T. Darrell, and A. Bayen, "Motion planning in understructured road environments with stacked reservation grids," *ICRA Workshop on Perception, Action, Learning*, Jun 2020

4. **F. Wu**, D. Wang, M. Hwang, C. Hao, J. Lu, T. Darrell, and A. Bayen, "Navigating through chaos: Planning with stacked reservation grid," *Berkeley DeepDrive Virtual Workshop*, May 2020

5. **F. Wu**, C. Zhang, X. Zhai, L. Yu, X. Cao, Y. Zhou, and A. Bayen, "An open robotics platform for multiagent learning and control," *Cyber-Physical Systems Principal Investigators' Meeting*, Nov 2019

6. **F. Wu** and D. Work, "Connections between car-following models and neural networks," *IEEE Intelligence Transportation Systems Conference*, Nov 2018

7. **F. Wu**, "A tutorial on simulation of urban mobility," *IEEE Intelligence Transportation Systems Conference*, Nov 2018

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

9. **F. Wu**, R. Stern, M. Churchill, and D. Work, "Fuel consumption in oscillatory traffic: experimental results," *Transportation Research Board 96th Annual Meeting*, Jan 2017

SERVICE AND OUTREACH

TECHNICAL ADVISING

Robot Open Autonomous Racing   UC Berkeley
Technical Advisor   Aug. 2021 – May 2023

- Advised a team of of undergraduate and graduate students in EE, CS, and ME in developing motion planning and state estimation algorithms for autonomous racing vehicles.
- The team has won second place at the 2022 Indy Autonomous Challenge held at the Texas Motor Speedway and earning third place at the 2023 Autonomous Challenge at the Consumer Electronics Show at the Las Vegas Motor Speedway.

Illinois Geometry Laboratory   UIUC
Technical Advisor   Jan. 2017 – Dec. 2017

- Advised on the development of deep learning algorithms on a NVIDIA Jetson MCU for facial and license plate recognition.
- Built a multi-GPU server which was shared among a group of 30 machine learning researchers, supervised by Prof. Richard Sowers.

COMMUNITY ENGAGEMENT

1. Berkeley AI Research Mentor, UC Berkeley, 2020 – 2024
2. Faculty Candidate Interview Student Committee Chair, UC Berkeley, 2023
3. Equal Access to Application Assistance Mentor, UC Berkeley, 2023
4. K12 Science Outreach, Ecole Bilingue de Berkeley, 2020

PEER REVIEWS

- Journal Reviewer: Automatica (2024), Nonlinear Analysis: Hybrid Systems (2023), IEEE RA-L (2024,2023), IEEE T-ITS (2019)
- Conference Reviewer: CDC (2023), IROS (2023), IEEE IV (2023), DI-CPS (2022), IEEE ITSC (2019, 2018)