David Fridovich-Keil

Curriculum Vitae

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Work Experience

Assistant Professor — **University of Texas, Austin**
Aerospace Engineering & Engineering Mechanics, 2021-*pres.*

Postdoc — **Stanford University**
Aeronautics & Astronautics, 2020-2021
Mentor: Mac Schwager

Postdoc — **University of California, Berkeley**
Electrical Engineering & Computer Sciences, June-August 2020
Mentor: Claire J. Tomlin

Education

PhD — **University of California, Berkeley**
Electrical Engineering & Computer Sciences, 2015-2020
Advisor: Claire J. Tomlin

BSE — **Princeton University**
Electrical Engineering, 2011-2015, *Summa Cum Laude*

Research Overview

My primary research interests lie in optimal control, dynamic game theory, and learning for robust autonomy. While I have also worked on a number of other projects related to distributed control, reinforcement learning, and active search, some my current research interests are:

- Posing interactive motion planning problems as multi-player, noncooperative dynamic games and designing efficient algorithms to solve them
- Inferring properties of game-theoretic interactions, such as equilibrium type, player objectives, and constraints
- Building a rapprochement between machine learning methods and classical techniques for robust, adaptive, and geometric control

Awards

1. **Demetri Angelakos Memorial Achievement Award**, Recognizes graduate students who, in addition to conducting research, unselfishly take the time to help colleagues beyond the normal cooperation existing between fellow students., *UC Berkeley EECS Department*, 2020.
2. **RSS Pioneer**, Workshop for top early-career robotics researchers., *Robotics: Science & Systems Pioneers Workshop*, 2019.
3. **Top Reviewer**, Rated one of the top 400 reviewers for NeurIPS 2019., *NeurIPS*, 2019.
4. **Outstanding Graduate Student Instructor**, Awarded to up to 9% of current GSIs throughout the university., *University of California Berkeley*, 2018.
5. **Charles Ira Young Memorial Prize**, Awarded each year to the student who excels in research in Electrical Engineering., *Princeton University*, 2015.
6. **G. David Forney Jr. Prize**, Awarded annually to a senior in Electrical Engineering Department. having an outstanding record in the communication science, systems & signals., *Princeton University*, 2015.
7. **James Hayes-Edger Palmer Prize**, Awarded annually to an engineering senior who has manifested excellent scholarship, a marked capacity for leadership and promise of creative achievement in engineering., *Princeton University*, 2015.
8. **NSF Graduate Research Fellowship**, *National Science Foundation*, 2015.

Teaching Experience

2021-*pres.* **Instructor**, *Aerospace Engineering & Engineering Mechanics*, University of Texas, Austin
ASE389: Modeling Multi-Agent Systems (Graduate)

2019 **Graduate Student Instructor**, *Electrical Engineering & Comp. Sciences*, UC Berkeley
CS70: Discrete Mathematics and Probability Theory (Undergraduate)

2017 **Graduate Student Instructor**, *Electrical Engineering & Comp. Sciences*, UC Berkeley
EE106A: Introduction to Robotics (Undergraduate and Masters)

2015 **Teaching Assistant**, *Dept. of Electrical Engineering*, Princeton University
ELE302: Building Real Systems (Undergraduate)

2013-2015 **Tutor**, *McGraw Center for Teaching & Learning*, Princeton University
MAT201/3: Vector Calculus (Undergraduate)
MAT202/4: Linear Algebra (Undergraduate)
PHY103: General Physics I (Undergraduate)

2013 **Tutor**, *Freshman Scholars Institute*, Princeton University
POL245: Visualizing Data (Undergraduate)

Industry Experience

2018 **Software Engineering**, *Nuro Inc.*, Moutain View, CA

2014 **Software Engineering**, *Applied Science & Tech. Research Inst.*, Hong Kong

2013 **Embedded Systems**, *Sentinel Photonics*, Monmouth Junction, NJ

Professional Activities

Professional Service – Leadership Roles

1. Coordinator, Semiautonomous Control Theory Seminar Series, UC Berkeley, 2018–2019.
2. President, Electrical Engineering Graduate Student Association, UC Berkeley, 2016–2017.
3. Coordinator, Workshop on Robust Autonomy: Tools for Safety in Real-World Uncertain Environments, Robotics: Science & Systems, 2019–2021.
4. Coordinator, CPAR/DREAM Robotics Seminar Series, UC Berkeley, 2019–2020.
5. Senator, Graduate Assembly, UC Berkeley, 2017–2020.

Professional Service – Committee Roles

1. Program Committee, Workshop on Opportunities and Challenges with Autonomous Racing, International Conference on Robotics and Automation, 2021.
2. Student Representative, Graduate Student Matters Committee, UC Berkeley Electrical Engineering and Computer Sciences, 2016–2017.
3. Social Committee, Electrical Engineering Graduate Student Association, UC Berkeley, 2015–2016.
4. Qualifying Exam Ombudsman, Electrical Engineering Graduate Student Association, UC Berkeley, 2018–2020.
5. Rotations Committee, Electrical Engineering Graduate Student Association, UC Berkeley, Working with faculty committee for graduate matters to design a rotations program for first year graduate students., 2017–2020.

Review activities

1. Advances in Neural Information Systems.
2. American Control Conference.
3. IEEE Conference on Control Technology and Applications.
4. IEEE Conference on Decision and Control.
5. IEEE International Conference on Robotics and Automation.
6. IEEE Robotics and Automation Letters.
7. IEEE Transactions on Automatic Control.
8. IEEE Transactions on Intelligent Vehicles.

9. IEEE Transactions on Robotics.
10. IEEE/RSJ International Conference on Intelligent Robots and Systems.
11. International Conference on Learning Representations.
12. Learning for Dynamics and Control.
13. Optimization Methods and Software.
14. Robotics: Science and Systems.

Mentorship Activities

1. High School Summer Research Mentor, Hybrid Systems Lab, 2019.
2. Session Leader, Girls in Engineering Summer Camp, 2019.
3. Volunteer, Bay Area Scientists in Schools, 2018–2019.
4. Undergraduate Research Mentor, Hybrid Systems Lab, 2017–2019.
5. Graduate Research Mentor, Hybrid Systems Lab, 2018–2020.
6. Session Leader, Get Science, Engineering, and Technology SWE Summer Camp, 2018-2019.

Academic Publications and Presentations

* indicates equal contribution

Journal articles

1. E. Rolf*, **D. Fridovich-Keil***, M. Simchowitz, B. Recht, and C. J. Tomlin, ''A successive-elimination approach to adaptive robotic sensing,'' *IEEE Transactions on Robotics*, 2020.
2. **D. Fridovich-Keil***, A. Bajcsy*, J. F. Fisac, S. L. Herbert, S. Wang, A. D. Dragan, and C. J. Tomlin, ''Confidence-aware motion prediction for real-time collision avoidance,'' *International Journal of Robotics Research*, 2019.
3. R. Dobbe, O. Sondermeijer, **D. Fridovich-Keil**, D. Arnold, D. Callaway, and C. J. Tomlin, ''Towards distributed energy services: Decentralizing optimal power flow with machine learning,'' *IEEE Transactions on Smart Grid*, 2019.

Conference papers

1. **D. Fridovich-Keil** and C. J. Tomlin, ''Approximate solutions to a class of reachability games,'' in *International Conference on Robotics and Automation (ICRA)*, 2021.
2. C.-Y. Chiu*, **D. Fridovich-Keil***, and C. J. Tomlin, ''Encoding defensive driving as a dynamic nash game,'' in *International Conference on Robotics and Automation (ICRA)*, 2021.
3. F. Laine, **D. Fridovich-Keil**, C.-Y. Chiu, and C. J. Tomlin, ''Multi-hypothesis interactions in game-theoretic motion planning,'' in *International Conference on Robotics and Automation (ICRA)*, 2021.

4. J. Li, **D. Fridovich-Keil**, S. Sojoudi, and C. Tomlin, ''Augmented lagrangian method for instantaneously constrainedreinforcement learning problems,'' in *Conference on Decision and Control (CDC)*, 2021.
5. L. Peters, **D. Fridovich-Keil**, V. Rubies-Royo, C. Tomlin, and C. Stachniss, ''Inferring objectives in continuous dynamic games from noise-corrupted partial state observations,'' in *Robotics: Science and Systems*, 2021.
6. **D. Fridovich-Keil**, E. Ratner, L. Peters, A. D. Dragan, and C. J. Tomlin, ''Efficient iterative linear-quadratic approximations for nonlinear multi-player general-sum differential games,'' in *International Conference on Robotics and Automation (ICRA)*, 2020.
7. **D. Fridovich-Keil***, V. Rubies-Royo*, and C. J. Tomlin, ''An iterative quadratic method for general-sum differential games with feedback linearizable dynamics,'' in *International Conference on Robotics and Automation (ICRA)*, 2020.
8. L. Peters, **D. Fridovich-Keil**, C. J. Tomlin, and Z. Sunberg, ''Inference-based strategy alignment for general-sum differential games,'' in *International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, 2020.
9. T. Westenbroek*, **D. Fridovich-Keil***, E. Mazumdar*, S. Arora, V. Prabhu, S. S. Sastry, and C. J. Tomlin, ''Feedback linearization for unknown systems via reinforcement learning,'' in *International Conference on Robotics and Automation (ICRA)*, 2020.
10. T. Westenbroek, E. Mazumdar, **D. Fridovich-Keil**, V. Prabhu, C. J. Tomlin, and S. S. Sastry, ''Adaptive control for linearizable systems using on-policy reinforcement learning,'' in *Conference on Decision and Control (CDC)*, 2020.
11. **D. Fridovich-Keil***, J. F. Fisac*, and C. J. Tomlin, ''Safely probabilistically complete real-time planning and exploration in unknown environments,'' in *International Conference on Robotics and Automation (ICRA)*, 2019.
12. S. L. Herbert*, A. Bajcsy*, **D. Fridovich-Keil**, J. F. Fisac, S. Deglurkar, A. D. Dragan, and C. J. Tomlin, ''A scalable framework for real-time multi-robot, multi-human collision avoidance,'' in *International Conference on Robotics and Automation (ICRA)*, 2019.
13. V. Rubies-Royo, **D. Fridovich-Keil**, S. L. Herbert, and C. J. Tomlin, ''A classification-based approach for approximate reachability,'' in *International Conference on Robotics and Automation (ICRA)*, 2019.
14. **D. Fridovich-Keil***, S. L. Herbert*, J. F. Fisac, S. Deglurkar, and C. J. Tomlin, ''Planning, fast and slow: A framework for adaptive real-time safe trajectory planning,'' in *International Conference on Robotics and Automation (ICRA)*, 2018.
15. J. F. Fisac*, A. Bajcsy*, S. L. Herbert, **D. Fridovich-Keil**, S. Wang, C. J. Tomlin, and A. D. Dragan, ''Probabilistically safe robot planning with confidence-based human predictions,'' in *Robotics: Science and Systems (RSS)*, 2018.
16. **D. Fridovich-Keil**, N. Hanford, M. P. Chapman, C. J. Tomlin, M. K. Farrens, and D. Ghosal, ''A model predictive control approach to flow pacing for TCP,'' in *55th Annual Allerton Conference on Communication, Control, and Computing*, 2017.
17. **D. Fridovich-Keil**, E. Nelson, and A. Zakhor, ''AtomMap: A probabilistic amorphous 3D map representation for robotics and surface reconstruction,'' in *International Conference on Robotics and Automation (ICRA)*, 2017.

18. R. Dobbe*, **D. Fridovich-Keil***, and C. J. Tomlin, ''Fully decentralized policies for multi-agent systems: An information theoretic approach,'' in *Advances in Neural Information Processing Systems*, 2017.

Manuscripts under review

1. F. Laine, **D. Fridovich-Keil**, C.-Y. Chiu, and C. Tomlin, ''The computation of approximate generalized feedback nash equilibria,'' *SIAM Journal on Optimization (under review)*, 2021.

Workshops and invited presentations

1. RSS Workshop on Perception and Control for Autonomous Navigation in Crowded, Dynamic Environments, *A Brief Tour of Dynamic Games for Multi-Agent Modeling*, 2021.
2. University of California, Berkeley, Semiautonomous Seminar, *A Brief Tour of Dynamic Games for Multi-Agent Modeling*, 2021.
3. NASA ULI joint meeting, *Parallelizable Methods for Multimodal Stochastic Optimal Control*, 2021.
4. University of California, Berkeley, Semiautonomous Seminar, *Parallelizable Methods for Multimodal Stochastic Optimal Control*, 2021.
5. RSS Pioneers, *Robotics Research Debate*, 2021.
6. University of Michigan, Connected and Automated Vehicles (CAV), *A Scalable Framework for Real-Time Multi-Robot, Multi-Human Collision Avoidance*, 2019.
7. University of California, Berkeley, CITRIS/CPAR Control Theory and Automation Symposium, *A Scalable Framework for Real-Time Multi-Robot, Multi-Human Collision Avoidance*, 2019.
8. Robotic Manipulation and Interaction (EE 106B), University of California, Berkeley, *Iterative Linear Quadratic Approximations for Nonlinear Differential Games*, 2019.
9. Berkeley Artificial Intelligence Research (BAIR) Retreat, University of California, Berkeley, *Iterative Linear Quadratic Approximations for Nonlinear Multi-Player General-Sum Differential Games*, 2019.
10. DARPA Assured Autonomy Program, *Toward Robust Autonomy in Multi-Agent Safety-Critical Systems*, 2019.
11. Postmates X, *Toward Robust Autonomy in Multi-Agent Safety-Critical Systems*, 2019.
12. Department of Aeronautics & Astronautics, Stanford University, Multi-Agent Systems Lab, *Toward Robust Autonomy in Uncertain Safety-Critical Systems*, 2019.
13. Department of Aeronautics & Astronautics, Stanford University, Autonomous Systems Lab, *Toward Robust Autonomy in Uncertain Safety-Critical Systems*, 2019.
14. Nuro Inc., *Toward Robust Autonomy in Uncertain Safety-Critical Systems*, 2019.
15. Robotics: Science & Systems, Pioneers Workshop, *Toward Robust Autonomy in Uncertain Safety-Critical Systems*, 2019.

16. VeHiCal Annual Workshop, University of California, Berkeley, *A Scalable Framework for Real-Time Multi-Robot, Multi-Human Collision Avoidance*, 2018.
17. University of California, Santa Cruz, CITRIS/CPAR Control Theory and Automation Symposium, *Probabilistically Safe Robot Planning with Confidence-Based Human Predictions*, 2018.
18. Berkeley Artificial Intelligence Research (BAIR) Seminar Series, University of California, Berkeley, *Probabilistically Safe Robot Planning with Confidence-Based Human Predictions*, 2018.
19. Bay Area Robotics Symposium (BARS), Stanford University, *Probabilistically Safe Robot Planning with Confidence-Based Human Predictions*, 2018.
20. Bay Area Robotics Symposium (BARS), University of California, Berkeley, *Planning, Fast and Slow: A Framework for Adaptive Real-Time Safe Trajectory Planning*, 2017.
21. VeHiCal Annual Workshop, University of California, Berkeley, *Planning, Fast and Slow: A Framework for Adaptive Real-Time Safe Trajectory Planning*, 2017.
22. Berkeley Artificial Intelligence Research (BAIR) Seminar Series, University of California, Berkeley, *Planning, Fast and Slow with FaSTrack*, 2017.