Sylvia Herbert

Curriculum Vitae

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Current Position

Assistant Professor, **UC San Diego**, *Mechanical and Aerospace Engineering*, 2020-present

Former

PhD   **University of California, Berkeley**, *Electrical Engineering*, 2020
         Advisor: Claire J. Tomlin

BS/MS   **Drexel University**, *Mechanical Engineering*, 2014
         magna cum laude, Advisor: Adam Fontecchio

Research Overview

My research focus is to enable efficient and safe decision-making in complex autonomous systems, while reasoning about uncertainty in real-world environments and human interactions. These techniques are backed by both rigorous theoretical guarantees and physical testing on robotic platforms. Specifically, my main research areas are:

1. **Advancing the theory of optimal control for dynamic games in high dimensions:** introducing new formulations, theorems, and algorithms for scalable high-dimensional safety analysis.
2. **Enabling adaptable safety assurances via learning:** using techniques from reinforcement learning to update safety assurances while maintaining theoretical guarantees.
3. **Human-inspired decision-making in autonomous systems:** transferring human decision-making models from cognitive science to autonomous systems to mimic human strengths in safe real-time planning.
4. **Safety assurance for dynamic environments and human-centered robotic systems:** harnessing Bayesian learning to validate predictions of humans and other agents in real time, enabling robots to avoid collisions with other agents with high probability.

Awards

1. **Outstanding Leadership Award Nomination**, "significantly impacted the campus or the community through innovation, collaboration, and the quality of leadership they have displayed", *Dean of Students, University of California Berkeley*, 2019.
2. **Rising Stars in Electrical Engineering and Computer Sciences**, 2019.
3. **Rising Stars in Mechanical Engineering**, 2019.
4. **Demetri Angelakos Memorial Achievement Award for Altruism**, "in addition to conducting research, unselfishly takes the time to help colleagues beyond the normal cooperation existing between fellow students", *Electrical Engineering and Computer Science Department, University of California Berkeley*, 2018.
5. **Outstanding Graduate Student Instructor**, Awarded to up to 9% of current GSIs throughout the university, *University of California Berkeley*, 2018.
6. **Chancellor's Fellowship**, *University of California Berkeley*, 2014.
7. **Graduate Research Fellowship (NSF GRFP)**, *National Science Foundation*, 2014.

Teaching Experience

2018 **Optimization Models in Engineering (EE 127/227A)**, UC Berkeley
Graduate Student Instructor for Professors Alex Bayen and Gireeja Ranade
Received high student evaluations: 4.8/5

2017   **Linear Systems Theory (EE 221A)**, UC Berkeley
Graduate Student Instructor for Professor Claire Tomlin
Achieved 2018 Outstanding GSI Award, awarded to up to 9% of GSIs university-wide.

2013 **Computer Aided Engineering Design (MEM 435)**, Drexel University
Teaching Assistant for Professor James Tangorra
Received high student evaluations: 4.8/5

Professional Activities

PROFESSIONAL SERVICE – LEADERSHIP ROLES

1. Co-Chair, Workshop on Debates on the Future of Robotics Research, International Conference on Robotics and Automation, 2020.

2. Co-Chair, Tutorial on Hamilton-Jacobi Reachability Analysis, IEEE Conference on Decision and Control, 2017.

3. President, Electrical Engineering Graduate Student Association, UC Berkeley, 2017–2018.

4. Co-Chair, Workshops on Robust Autonomy: Tools for Safety in Real-World Uncertain Environments, Robotics: Science and Systems, 2019–2020.

5. Chair, Electrical Engineering and Computer Science Peer Mentorship Program, UC Berkeley, 2018–2020.

6. Chair, Electrical Engineering and Computer Science Wellness Committee, UC Berkeley EECS, 2017–2020.

7. Lead Coordinator, People and Robots Seminar Series, coordinated across 5 labs through the Center for Information Technology Research in the Interest of Society (CITRIS), UC Berkeley, 2017–2020.

8. President, Pi Tau Sigma (Mechanical Engineering Honors Society), Drexel Xi Chapter, 2013–2014.

PROFESSIONAL SERVICE – COMMITTEE ROLES

1. Program Committee Member, Conference on Robot Learning (CoRL), 2020.

2. Program Committee Member, Multi-Robot and Multi-Agent Systems, 2018.

3. Committee Member, Systems Engineering Committee, UCSD MAE, 2020–*pres.*

4. Student Representative, Graduate Student Matters Committee, UC Berkeley EECS, 2017–2018.

5. Student Ombudsperson, Electrical Engineering Prelim Committee, UC Berkeley, 2016–2018.

6. Student Ombudsperson, Faculty Interview Committee, UC Berkeley EECS, 2018–2020.

7. Student Representative, Mechanical Engineering Undergraduate Curriculum Committee, Drexel University, 2013–2014.

8. Student Representative, Mechanical Engineering Tenure Review Committee, Drexel University, 2013–2014.

9. Student Representative, Mechanical Engineering Department Head Search Committee, Drexel University, 2013–2014.

10. Student Representative, Mechanical Engineering Faculty Search Committee, Drexel University, 2013–2014.

11. Communications Chair, Society of Women Engineers, Drexel University, 2010–2011.

Professional Honors

1. Selected Participant, Rising Stars in Electrical Engineering and Computer Sciences Workshop, University of Illinois Urbana-Champaign, 2019.

2. Selected Participant, Rising Stars in Mechanical Engineering, Stanford University, 2019.

3. Selected Participant, Future Digileaders, KTH Royal Institute of Technology, 2019.

4. Selected Participant, Microsoft Research AI Breakthroughs Workshop, 2019.

5. Graduate Fellow, Workshop on Algorithmic Foundations of Robotics Robot Guru, 2018.

6. Selected Participant, NextProf Workshop: Preparing the Next Generation of Scientific and Technological Leaders, 2018.

7. Selected Participant, iREDEFINE Workshop: Improving the Diversity of Faculty in Electrical and Computer Engineering, 2018.

Review activities

1. Automatica.

2. Conference on Robot Learning (CoRL).

3. IEEE International Conference on Decision and Control.

4. IEEE International Conference on Robotics and Automation.

5. IEEE Robotics and Automation Letters.

6. IEEE Robotics and Automation Magazine.

7. IEEE Transactions on Robotics.

8. Journal of Artificial Intelligence Research.

0. Robotics: Science and Systems.

Mentorship Activities

1. Society of Women Engineers (SWE) Graduate Mentor, 2019–2020.

2. Women in CS and Engineering Mentor, 2018–2020.

3. Berkeley Artificial Intelligence Research Mentor, 2017–2020.

4. Berkeley Electrical Engineering and Computer Science Peer Mentor, 2016–2020.

5. Graduate Research Mentor, Hybrid Systems Lab, *Mentored 5 undergraduate and 6 graduate students*, 2016–2020.

6. Drexel Students Tackling Advanced Research (STAR) Mentor, 2012–2013.

Bibliographical information

* indicates equal contribution

Journal Publications

1. **S.L. Herbert***, D. Fridovich-Keil*, V. Rubies-Royo, and C. J. Tomlin, "Metareasoning for computationally adaptive planning in robotics," *IEEE Transactions on Automatic Control (in prep)*, 2020.

3. 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 (IJRR, invited paper)*, 2019.

4. M. Chen, **S.L. Herbert**, M. Vashishtha, S. Bansal, and C. J. Tomlin, "A general system decomposition method for computing reachable sets and tubes," *IEEE Transactions on Automatic Control (TAC)*, 2018.

5. R. Kressly, **S.L. Herbert**, P. Ross, and D. Votsch, "Portable inspiration: The necessity of STEM outreach investment," *Technology and Engineering Teacher*, vol. 68, no. 7, p. 26, 2009.

Peer-Reviewed Conference Publications

1. **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," *International Conference on Robotics and Automation (ICRA)*, 2019.

2. **S.L. Herbert**, S. Ghosh, S. Bansal, and C. J. Tomlin, "Reachability-based safety guarantees using efficient initializations," *Conference on Decision and Control (CDC)*, 2019.

3. V. Rubies-Royo, D. Fridovich-Keil, **S.L. Herbert**, and C. J. Tomlin, "A classification-based approach for approximate reachability," *International Conference on Robotics and Automation (ICRA)*, 2019.

4. **S.L. Herbert***, D. Fridovich-Keil*, 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.

5. 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.

6. S. Singh, M. Chen, **S.L. Herbert**, C. J. Tomlin, and M. Pavone, "Robust tracking with model mismatch for fast and safe planning: An SOS optimization approach," *Workshop on the Algorithmic Foundations of Robotics (WAFR)*, 2018.

7. **S.L. Herbert***, M. Chen*, S. Han, S. Bansal, J. F. Fisac, and C. J. Tomlin, "FaSTrack: A modular framework for fast and guaranteed safe motion planning," in *Conference on Decision and Control (CDC)*, 2017.

8. S. Bansal, M. Chen, **S.L. Herbert**, and C. J. Tomlin, "Hamilton-Jacobi reachability: A brief overview and recent advances," in *Conference on Decision and Control (CDC)*, 2017.

9. M. Chen, **S.L. Herbert**, and C. J. Tomlin, "Exact and efficient Hamilton-Jacobi-based guaranteed safety analysis via system decomposition," *International Conference on Robotics and Automation (ICRA)*, 2017.

10. **S.L. Herbert***, M. Chen*, and C. J. Tomlin, "Fast reachable set approximations via state decoupling disturbances," *Conference on Decision and Control (CDC)*, 2016.

11. B. Terranova, A. A. Bellingham, **S.L. Herbert**, and A. K. Fontecchio, "Cylindrical channel plasmon resonance for single-molecule sensing," *International Society for Optics and Photonics Conference (SPIE)*, 2014.

12. D. A. Delaine, **S.L. Herbert**, and A. K. Fontecchio, "An optical induction generator through Crooke's radiometer," *International Society for Optics and Photonics Conference (SPIE)*, 2010.

INVITED PRESENTATIONS

8. Aerospace Seminar, University of Washington, *Safe Real-World Autonomy in Uncertain and Unstructured Environments*, 2020.

1. ECE Seminar, UC Los Angeles, *Safe Real-World Autonomy in Uncertain and Unstructured Environments*, 2020.

2. MAE, ECE, and CS Seminars (all separately), UC San Diego, *Safe Real-World Autonomy in Uncertain and Unstructured Environments*, 2020.

3. Aerospace and EECS Seminars (separately), MIT, *Safe Real-World Autonomy in Uncertain and Unstructured Environments*, 2020.

4. ECE Seminar, University of Pennsylvania, *Safe Real-World Autonomy in Uncertain and Unstructured Environments*, 2020.

5. Robotics Seminar, Harvard University, *Safe Real-World Autonomy in Uncertain and Unstructured Environments*, 2020.

6. Combined ME/ECE Seminar, Boston University, *Safe Real-World Autonomy in Uncertain and Unstructured Environments*, 2020.

7. ME Seminar, UC Berkeley, *Safe Real-World Autonomy in Uncertain and Unstructured Environments*, 2020.

10. ECE Systems Science Seminar, Michigan University, *Safe and Efficient Control for Dynamic Systems*, 2019.

11. Stanford Robotics Symposium, Stanford University, *Safe and Efficient Control for Dynamic Systems*, 2019.

12. Aerospace Seminar, University of Washington, *Safe and Efficient Robots Inspired by Cognitive Science*, 2019.

13. Robotics Seminar, Simon Fraser University, *Safe and Efficient Robots Inspired by Cognitive Science*, 2019.

14. Collaborative Advanced Robotics and Intelligent Systems Laboratory (CARIS) Seminar, University of British Columbia, *Safe and Efficient Robots Inspired by Cognitive Science*, 2019.

9. CompSci Colloquium, University of Colorado Boulder, *Safe Real-World Autonomy in Uncertain and Unstructured Environments*, 2019.

15. Autonomous Systems Seminar Series, University of Colorado, Boulder, *Fast and Safe Navigation for Autonomous Dynamic Systems with Application to Pedestrian Avoidance*, 2018.

16. American Society of Mechanical Engineers Seminar Series, Drexel University, *Fast and Safe Navigation for Autonomous Systems*, 2018.

17. Berkeley Artificial Intelligence Research (BAIR) Seminar Series, University of California, Berkeley, *Probabilistically Safe Robot Planning with Confidence-Based Human Predictions*, 2018.

18. Centre for Intelligent Machines Seminar Series, McGill University, *Safe and Efficient Control for Dynamic Systems*, 2018.

19. Aerospace Seminar, Stanford University, *High-Dimensional Reachability Analysis: Addressing the 'Curse of Dimensionality' in Verification*, 2017.

20. Berkeley Artificial Intelligence Research (BAIR) Seminar Series, University of California, Berkeley, *Planning, Fast and Slow with FaSTrack*, 2017.

21. Bay Area Robotics Symposium (BARS), University of California, Berkeley, *Real-Time Dynamic Planning with Safety Guarantees*, 2017.

22. Bay Area Robotics Symposium (BARS), Stanford University, *Decoupling as Disturbance in Reachability Analysis*, 2016.

23. Johns Hopkins Center for Talented Youth in Science and Technology Series, Drexel University, *Adding Creativity to STEM: The ExCITe Center*, 2013.

24. Physics Courses, Lower Merion High School, *The Pursuit of an Engineering Degree: My Journey as an Engineering Student*, 2013.

25. Annual Conference, Teacher Education Association of Pennsylvania, *Encouraging and Maintaining Women in Engineering*, 2011.