Samuel Pfrommer

Education University of California, Berkeley, Berkeley, CA Aug '21–Present O PhD student — Department of Electrical Engineering and Computer Sciences University of Pennsylvania, Philadelphia, PA Aug '17-May '21 BSE Computer Science (second major Mathematics) — School of Engineering and Applied Science Work Experience Machine Learning Researcher, University of California, Berkeley, Berkeley, CA Aug '21-Present O Conduct research on robust machine learning, reinforcement learning, and controls Developed novel architectures enabling tractable robustness certificates (1000x faster than SOTA) • Studied various safety-related problems in reinforcement / imitation learning Graph Neural Networks Researcher, University of Pennsylvania, Philadelphia, PA May '20-July '21 Developed and theoretically analyzed a notion of discriminability for graph learning architectures Contact Dynamics Researcher, University of Pennsylvania, Philadelphia, PA May '19-May '20 O Conducted research on learning contact dynamics for robotic manipulation Combined novel parameterization and loss function to yield over 10x data efficiency improvements w.r.t. baselines Developed 10,000-line codebase including method implementations and a 300-instance cloud deployment system Set up AprilTag-based tracking system for recording a manipulation dataset with 750 tosses CIS 160 and ESE 224 Teaching Assistant, University of Pennsylvania, Philadelphia, PA Aug '18-May '20 • TA'd for CIS 160 (proofs, combinatorics, probability, graph theory) and ESE 224 (signal processing) CIS 160 for 20 hours/wk from Aug '18 to Dec '18; ESE 224 for 10 hrs/wk from Feb '20 to May '20 Taught recitations, held office hours, wrote homeworks, graded homeworks and exams Digital Products Development Intern, Porsche, Weissach, BW, Germany May '18-Aug '18 Analyzed large infotainment system datasets using Spark to facilitate data-driven development Built effective, management-tailored Qlik Sense BI dashboards with custom visualizations Software Engineering Intern, iRobot, Pasadena, CA Jun '17-Aug '17 ○ Refactored large preexisting C++ computational geometry code base to add cleaner abstractions Developed an efficient algorithm for computing nested connected components with border detection Robotics Intern, Oregon State University Dynamic Robotics Lab, Corvallis, OR Jun '16-Aug '16 Implemented telemetry interface (transmitter and receiver) for new bipedal robot Cassie Wrote firmware software for and compared three candidate inertial measurement units (IMUs) for Cassie - Employed extended Kalman filter to compensate against gyro bias - Analyzed g-sensitivity bias effects using numerical function optimization techniques - Concluded with 14-page report detailing findings (saved over \$10k by recommending move to cheaper IMU) Skills **Programming languages:** Python, C/C++, Java, MATLAB Software: PyTorch, Google Cloud Platform, ROS, Git, Vim, Linux, Docker, LATEX Machine learning: robust classification, reinforcement/imitation learning, computer vision

Robotics: contact dynamics & learned contact models, controls, legged locomotion, trajectory optimization **Mathematics:** graduate abstract algebra, real/complex analysis, theoretical statistics, topology, smooth manifolds. **Languages:** English (native), German (intermediate), Spanish (intermediate)

Awards, honors, grants

- NSF Graduate Research Fellowships Program honorable mention
- INFORMS 2022 Data Mining Best Paper Competition Award runner up (Student Track)
- Student Travel Grand Award IEEE Conference on Decision and Control (2022, 2023)
- Judge's choice award for senior design project Jazz-o-matic (2021)
- o 3rd place overall Formula SAE Electric 2019 out of 30 electric teams from across Americas
 - 2nd place autocross event, 3rd place endurance event (most important events)
 - Served as team lead for vehicle dynamics and machining (see activities)
- Penn Undergraduate Research Mentoring Program grant 2019

Selected publications

- Pfrommer, S., B. Anderson, and S. Sojoudi (2023). "Asymmetric Certified Robustness via Feature-Convex Neural Networks". In 37th Annual Conference on Neural Information Processing Systems (NeurIPS). https://arxiv.org/abs/2302.01961.
- Pfrommer, S., B. Anderson, and S. Sojoudi (2023). "Projected Randomized Smoothing for Certified Adversarial Robustness". In Transactions on Machine Learning Research (TMLR). https://arxiv.org/abs/2309.13794.
- Pfrommer, S., Y. Bai, et al. (2023). "Initial State Interventions for Deconfounded Imitation Learning". In 62nd IEEE Conference on Decision and Control (CDC). http://arxiv.org/abs/2307.15980.
- Anderson, B., S. Pfrommer, and S. Sojoudi (2023). "Tight Certified Robustness via Min-Max Representations of ReLU Neural Networks". In 62nd IEEE Conference on Decision and Control (CDC). http://arxiv.org/abs/2310.04916.
- Gautam, T., S. Pfrommer, and S. Sojoudi (2023). "Meta-Learning Parameterized First-Order Optimizers using Differentiable Convex Optimization". In 62nd IEEE Conference on Decision and Control (CDC). https://arxiv.org/abs/2303.16952.
- Pfrommer, S., T. Gautam, et al. (2022). "Safe Reinforcement Learning with Chance-constrained Model Predictive Control". In 4th Learning for Dynamics and Control Conference (L4DC). https://arxiv.org/abs/2112.13941.
- Pfrommer, S. and S. Sojoudi (2022). "LQR Control with Sparse Adversarial Disturbances". In 61st IEEE Conference on Decision and Control (CDC). https://arxiv.org/abs/2209.10629.
- Pfrommer, S., F. Gama, and A. Ribeiro (2021). "Discriminability of Single-Layer Graph Neural Networks". In 46th IEEE Int. Conf. on Acoustics, Speech and Signal Processing (ICASSP). https://arxiv.org/abs/2010.08847.
- Pfrommer*, S., M. Halm*, and M. Posa (2020). "ContactNets: Learning Discontinuous Contact Dynamics with Smooth, Implicit Representations". In 4th Conference on Robot Learning (CoRL). https://arxiv.org/abs/2009.11193.

Professional service

- Session chair for 5th NorCal Control Workshop
- Invited reviewer, International Conference on Machine Learning
- o Invited reviewer, International Conference on Learning Representations
- Invited reviewer, Conference on Neural Information Processing Systems
- o Invited reviewer, IEEE Conference on Decision and Control
- Session chair for at the 61st IEEE Conference on Decision and Control
- Session chair for Safety and Robustness in Machine Learning at the INFORMS 2022 Annual Meeting
- Session chair for the Artificial Intelligence Flash Session at the INFORMS 2022 Annual Meeting
- Berkeley EECS grad 2022 social chair, treasurer

Activities and projects

Open source founder, *TorchExplorer*

Developed and open-sourced TorchExplorer, an interactive neural network visualizer

Vehicle Dynamics Lead and Machining Lead, Penn Electric Racing

- Headed development of 8,000 line in-house vehicle dynamics simulator for optimizing design tradeoffs
- Coordinated machining for several hundred car parts, responsibilities included reviewing drawings, managing manufacturing timelines and permits, and assigning work to appropriate team members
- Mentored onboarding / training projects for new members

Oct '23-Present

Aug '18-May '20