Samuel Pfrommer

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Education

University of California, Berkeley, Berkeley, CA.   Aug '21–Present
- Incoming PhD student — Department of Electrical Engineering and Computer Sciences

University of Pennsylvania, *3.95/4.00 GPA*, Philadelphia, PA.   Aug '17–May '21
- BSE Computer Science (second major Mathematics) — School of Engineering and Applied Science

Darien High School, Darien, CT.   Aug '13–Jun '17

Work Experience

Graph Neural Networks Researcher, *University of Pennsylvania*, Philadelphia, PA.   May '20–Present
- Developed a notion of discriminability for graph learning architectures (advised by Prof. Alejandro Ribeiro)
- Theoretically analyzed discriminability impact of nonlinearities in graph neural networks (GNNs)
- Derived practically satisfied filter conditions for GNNs to be more discriminative than plain graph filters
- Examined impact of underlying graph support error on discriminative bounds

Robotic Manipulation Researcher, *University of Pennsylvania*, Philadelphia, PA.   May '19–May '20
- Conducted research on learning contact dynamics for robotic manipulation (advised by Prof. Michael Posa)
- 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 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.   Jul '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)

Software Development Intern, *Scientific Revenue*.   Aug '15–Jun '16
- Automated Pivotal Tracker project tasks and wrote web app for remote workers to input mobile device data
- Wrote tool for fetching, filtering, and analyzing logging output on remote servers

Skills

Programming languages: Python, C/C++, Java, MATLAB, Haskell
Software: PyTorch, Google Cloud Platform, Qlik Sense, Spark, ROS, Git, Vim, Linux, LaTeX
Robotics: manipulation, legged locomotion, numerical trajectory optimization, embedded systems development
Manufacturing: SOLIDWORKS, OnShape, metals machining, basic composites and woodworking
Languages: English (native), German (professional proficiency), Spanish (intermediate)

Accepted publications

Pfrommer, S., F. Gama, and A. Ribeiro (2021). "Discriminability of Single-Layer Graph Neural Networks". In *IEEE Int. Conf. on Acoustics, Speech and Signal Processing*. https://arxiv.org/abs/2010.08847.

Pfrommer*, S., M. Halm*, and M. Posa (2020). "ContactNets: Learning Discontinuous Contact Dynamics with Smooth, Implicit Representations". In *Conference on Robot Learning*. https://arxiv.org/abs/2009.11193.

Accepted presentations

Pfrommer*, S., M. Halm*, and M. Posa (2020). "Efficient Learning of Discontinuous Contact Dynamics with Smooth Parameterizations". In *Robotics: Science and Systems, Structured Approaches to Robot Learning Workshop*.

Pfrommer, S. (2017). "Key Control Strategies Emerge in Spring Loaded Inverted Pendulum Traversal of Slippery Terrain". In *Dynamic Walking*.

Projects

- **Pressure field estimation** around airfoil cross sections with convolutional neural networks
  - Implemented generation of ground-truth OPENFOAM pressure fields around airfoils in the UIUC Airfoil Database
  - Compared convolutional and U-Net models on Google Cloud Platform deep learning instances
- **Rear wing profile optimization** for Formula SAE Electric vehicle using genetic algorithms
  - Optimized positions and angles for multi-element wings based on aerodynamic design criteria
  - Generated high-downforce rear wing design that outperformed hand designed placements in full-car Star CCM simulation
- **Bipedal robot trajectory optimization** over low-friction terrain
  - Observed the emergence of traversal strategies previously noted in human locomotion over slippery surfaces
  - Accepted to and gave talk at the Dynamic Walking 2017 robotics conference: see extended abstract
- **Legged helicopter landing gear**
  - Independently designed, constructed, and tested novel legged landing gear for an RC helicopter
  - Uses shock-absorbing springs, force sensors, and retraction reflexes to land with high speed on uneven terrain

Selected courses

- Graduate engineering: Machine Learning (CIS 520), Graph Neural Networks (ESE 680), Convex Optimization (ESE 605), Quantum Engineering (ESE 423), Software Foundations (CIS 500)
- Graduate mathematics: Real Analysis (MATH 508 / 509, single & multi), Modern Real Analysis and Complex Analysis (MATH 608), Topology (MATH 500), Abstract Algebra (MATH 502), Advanced Linear Algebra (MATH 314, undergraduate)

Awards, honors, grants

- 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
- Dean's list 2017-2018 and 2018-2019 (last year suspended due to Covid-19)
- Applied to NSF GRFP, DoD NDSEG fellowships

Activities

Vehicle Dynamics Lead and Machining Lead, *Penn Electric Racing*.   Aug '18–May '20

- 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