Brendon G. Anderson

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I am on the academic job market as of Fall 2023. Please feel free to reach out if you know of relevant open positions, or if you'd like to get to know me and my research.

Research Interests

I am interested in the development and analysis of safe and reliable computational methods by applying rigorous mathematics to interdisciplinary problems in the areas of **optimization**, **machine learning**, **control theory**, and **game theory**. My latest projects surround provable safety for neural networks using robust optimization theory, stability guarantees for infinite-dimensional evolutionary games using functional analysis, and robust control of distributed systems using optimal transport theory.

Education

University of California, Berkeley Aug. 2018 – May 2024 (Expected)
Ph.D. in Control Theory
Advisor: Somayeh Sojoudi
Research Areas: Optimization, Machine Learning, Control Theory
Minors: Mathematics, Optimization

University of California, Berkeley Aug. 2022 – Dec. 2023 (Expected)
M.A. in Mathematics
Thesis: "Dissipativity theory for evolutionary games on infinite strategy sets"

University of California, Berkeley Aug. 2018 – May 2020
M.S. in Control Theory
Thesis: "Towards optimality and robustness guarantees for data-driven learning and decision making"

University of California, Los Angeles Sep. 2015 – Mar. 2018
B.S. in Mechanical Engineering (*summa cum laude*)
Technical Breadth Area: Mathematics

Research Experience

Graduate Student Researcher — UC Berkeley Aug. 2018 – Present
Advisor: Somayeh Sojoudi

Jr. Development Engineer — UCLA Engineering Jan. 2018 – Jun. 2018
Advisor: Robert M'Closkey

Research Assistant — UCLA Mathematics Jun. 2017 – Aug. 2017
Advisors: Matt Haberland, Olga Turanova, and Andrea L. Bertozzi

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Awards

1. Second place method on RobustBench CIFAR-100 ℓ_∞-leaderboard   May 2023
   For the paper "Improving the accuracy-robustness trade-off of classifiers via adaptive smoothing."

2. Graduate Division Block Grant Award, UC Berkeley   May 2023

3. Outstanding Graduate Student Instructor Award, UC Berkeley   Mar. 2023
   Schoolwide award for teaching excellence.

4. INFORMS Data Mining Best Student Paper Award Runner-Up   Oct. 2022
   For the paper "Projected randomized smoothing for certified adversarial robustness."

5. Graduate Division Block Grant Award, UC Berkeley   May 2022

6. John and Janet McMurtry Fellowship, UC Berkeley   Dec. 2020
   Departmental award for academic excellence, sole recipient.

7. Travel Support Award, Conference on Decision and Control   Dec. 2020

8. Graduate Assembly Professional Development Award, UC Berkeley   Aug. 2020

9. Graduate Division Block Grant Award, UC Berkeley   May 2019

10. Harry M. Showman Prize, UCLA   Jun. 2018
    Schoolwide research award, sole undergraduate recipient.

11. Jonathan David Wolfe Memorial Scholarship, UCLA   Apr. 2018
    Departmental award for academic excellence, one of two recipients.

Publications * indicates equal contribution.

[1] **B. G. Anderson**, Z. Ma, J. Li, and S. Sojoudi, "Towards optimal branching of linear and semidefinite relaxations for neural network robustness certification," *Under review*, 2023. URL https://arxiv.org/pdf/2101.09306.pdf.

[2] S. Pfrommer*, **B. G. Anderson***, J. Piet, and S. Sojoudi, "Asymmetric certified robustness via feature-convex neural networks," *Under review*, 2023. URL https://brendon-anderson.github.io/files/publications/pfrommer2023asymmetric.pdf.

[3] S. Pfrommer, **B. G. Anderson**, and S. Sojoudi, "Projected randomized smoothing for certified adversarial robustness," *Under review*, 2023. **INFORMS Data Mining Best Student Paper Award Runner-Up**. URL https://brendon-anderson.github.io/files/publications/pfrommer2023projected.pdf.

[4] Y. Bai, **B. G. Anderson**, A. Kim, and S. Sojoudi, "Improving the accuracy-robustness trade-off of classifiers via adaptive smoothing," *Under review*, 2023. **Second place method on RobustBench CIFAR-100 ℓ_∞-leaderboard as of May 2023**. URL https://bai-yt.github.io/files/publications/AdaptiveSmoothing_PrePrint.pdf.

[5] **B. G. Anderson**, S. Pfrommer, and S. Sojoudi, "Tight certified robustness via min-max representations of ReLU neural networks," in *Proceedings of the 62nd IEEE Conference on Decision and Control (CDC)*, 2023.

[6] Y. Bai, **B. G. Anderson**, and S. Sojoudi, "Mixing classifiers to alleviate the accuracy-robustness trade-off," in *Proceedings of the 7th IEEE Conference on Control Technology and Applications (CCTA)*, 2023.

[7] **B. G. Anderson***, T. Gautam*, and S. Sojoudi, "An overview and prospective outlook on robust training and certification of machine learning models," in *IFAC Symposium on System Structure and Control (SSSC)*, 2022.

[8] T. Gautam, **B. G. Anderson**, S. Sojoudi, and L. El Ghaoui, "A sequential greedy approach for training implicit deep models," in *Proceedings of the 61st IEEE Conference on Decision and Control (CDC)*, 2022.

[9] **B. G. Anderson** and S. Sojoudi, "Data-driven certification of neural networks with random input noise," *IEEE Transactions on Control of Network Systems (TCNS)*, 2022.

[10] **B. G. Anderson**, S. Pfrommer, and S. Sojoudi, "Towards optimal randomized smoothing: A semi-infinite linear programming approach," in *ICML Workshop on Formal Verification of Machine Learning (WFVML)*, 2022. One of six selected for oral presentation.

[11] **B. G. Anderson** and S. Sojoudi, "Certified robustness via locally biased randomized smoothing," in *Proceedings of the 4th Annual Learning for Dynamics and Control Conference (L4DC)*, 2022.

[12] F. Gama, **B. G. Anderson**, and S. Sojoudi, "Node-variant graph filters in graph neural networks," in *Proceedings of the IEEE Data Science and Learning Workshop (DSLW)*, 2022.

[13] **B. G. Anderson**, Z. Ma, J. Li, and S. Sojoudi, "Tightened convex relaxations for neural network robustness certification," in *Proceedings of the 59th IEEE Conference on Decision and Control (CDC)*, 2020.

[14] **B. G. Anderson** and S. Sojoudi, "Global optimality guarantees for nonconvex unsupervised video segmentation," in *Proceedings of the 57th Annual Allerton Conference on Communication, Control, and Computing*, 2019.

[15] **B. G. Anderson**, E. Loeser, M. Gee, F. Ren, S. Biswas, O. Turanova, M. Haberland, and A. L. Bertozzi, "Quantifying robotic swarm coverage," in *Informatics in Control, Automation and Robotics: 15th International Conference, ICINCO 2018, Porto, Portugal, July 29–31, 2018, Revised Selected Papers*, vol. 613 of *Lecture Notes in Electrical Engineering*, pp. 276–301, Springer, 2019.

[16] **B. G. Anderson**, E. Loeser, M. Gee, F. Ren, S. Biswas, O. Turanova, M. Haberland, and A. L. Bertozzi, "Quantitative assessment of robotic swarm coverage," in *Proceedings of the 15th International Conference on Informatics in Control, Automation and Robotics (ICINCO)*, 2018.

| **Invited Talks and Poster Presentations** | 1. | INFORMS Annual Meeting, Indianapolis, IN | Oct. 2022 |
| | | "Projected randomized smoothing for certified adversarial robustness." Research talk. | |

2. NorCal Control Workshop, UC Santa Cruz, Santa Cruz, CA   June 2022
   "Certified robustness via locally biased randomized smoothing." Research poster presentation.

3. Tsinghua-Berkeley Shenzhen Institute, Berkeley, CA   May 2022
   "Robust neural networks." Guest lecture for *Optimization Theory and Machine Learning*.

4. INFORMS Annual Meeting, Anaheim, CA   Oct. 2021
   "Data-driven certification of neural networks with random inputs." Research talk.

5. Tsinghua-Berkeley Shenzhen Institute, Berkeley, CA   May 2021
   "Robust neural networks." Guest lecture for *Optimization Theory and Machine Learning*.

6. University of Michigan, Ann Arbor, MI   Apr. 2021
   "Robust neural networks." Guest lecture for *Advanced Topics in Applied Data Analytics* (IOE 491).

7. INFORMS Annual Meeting, National Harbor, MD   Nov. 2020
   "Partition-based convex relaxations for robustness certification of ReLU neural networks." Research talk.

8. Conference on Control Technology and Applications, Montréal   Aug. 2020
   "Robustness analysis of neural networks." Tutorial session.

9. Institute for Pure and Applied Mathematics, Los Angeles, CA   Aug. 2017
   "Robotic swarm analysis." Research talk.

Teaching

REU Mentor — UC Berkeley   Summer 2023
Mentor for SUPERB Research Experience for Undergraduates (REU) program, UC Berkeley Electrical Engineering and Computer Sciences (EECS) Department.
Mentee: Owen Frausto
Project: "Robust optimal transport over dynamical systems"

Graduate Student Instructor — UC Berkeley
1. *Convex Optimization* (EE 227BT)   Fall 2023

2. *Convex Optimization* (EE 227BT)   Fall 2022
   Recipient of the Outstanding Graduate Student Instructor Award.
   Student ratings: Mean 97.3%, Median 100%, Standard deviation 6.7%.

3. *Nonlinear and Discrete Optimization* (IEOR 160)   Fall 2021
   Student ratings: Mean 93.4%, Median 100%, Standard deviation 9.6%.

4. *Nonlinear and Discrete Optimization* (IEOR 160)   Fall 2020
   Student ratings: Mean 90.8%, Median 100%, Standard deviation 15.2%.

Guest Lecturer — UC Berkeley
1. *Nonlinear and Discrete Optimization* (IEOR 160)   Fall 2022
2. *Linear Programming and Network Flows* (IEOR 162)   Fall 2022
3. *Nonlinear and Discrete Optimization* (IEOR 160)   Fall 2021

Supplemental Instructor — Palomar College

1. *Electromagnetism* (PHYS 231)   Spring 2015
2. *General Chemistry* (CHEM 115)   Fall 2014, Spring 2015

Professional Activities

1. Co-organizer of the 2nd Workshop on Formal Verification of Machine Learning (WFVML), International Conference on Machine Learning (ICML), 2023.
2. Reviewer for Conference on Neural Information Processing Systems (NeurIPS), 2023.
3. Reviewer for Conference on Decision and Control (CDC), 2023.
4. Co-chair of the second morning session, NorCal Control Workshop, 2023.
5. Reviewer for International Conference on Machine Learning (ICML), 2023.
6. Reviewer for Learning for Dynamics and Control Conference (L4DC), 2023.
7. Reviewer for Conference on Neural Information Processing Systems (NeurIPS), 2022.
8. Reviewer for Conference on Decision and Control (CDC), 2022.
9. Organizer and co-chair of the session "Safety and Robustness in Machine Learning," INFORMS Annual Meeting, 2022.
10. Reviewer for IEEE Control Systems Letters, 2022.
11. Reviewer for IEEE Open Journal of Control Systems, 2022.
12. Organizer and co-chair of the session "Robustness of Neural Networks," INFORMS Annual Meeting, 2021.
13. Reviewer for Conference on Decision and Control (CDC), 2021.
14. Reviewer for IEEE Transactions on Automatic Control, 2021.
15. Reviewer for Artificial Intelligence and Statistics Conference (AISTATS), 2020.
16. Reviewer for American Control Conference (ACC), 2020.
17. Grant proposal contributor; assisted with writing DARPA funding proposal, 2019.
18. Chair of the session "Data Analytics," 57th Annual Allerton Conference on Communication, Control, and Computing, 2019.

Outreach

1. Graduate Student Mentor for incoming students, hosted by UC Berkeley Mechanical Engineering Graduate Student Council, 2023.
2. Volunteer for College Skateboarding Educational Foundation (CSEF), 2023. *Community event organizer to promote scholarships for skateboarders and to foster academia's inclusion of skateboarders from diverse backgrounds.*
3. Graduate Student Mentor for incoming students, hosted by UC Berkeley Mechanical Engineering Graduate Student Council, 2022.
4. Graduate Student Mentor for incoming students, hosted by UC Berkeley Mechanical Engineering Graduate Student Council, 2021.
5. Peer Advisor for the Bay Area Graduate Pathways to Stem (GPS) program, hosted by UC Berkeley Engineering and Stanford Engineering, 2020.

References   **Somayeh Sojoudi**   –
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