Brendon G. Anderson

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I am on the academic job market as of Fall 2023.

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 **machine learning**, **optimization**, **control theory**, and **game theory**. My latest projects surround provable safety for neural networks using robust optimization theory, stability guarantees for 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 Mechanical Engineering (Major in Control Theory)
Minors: Mathematics, Optimization
Advisor: Somayeh Sojoudi
Research Areas: Machine Learning, Optimization, Control Theory, Game Theory

University of California, Berkeley   Aug. 2022 – Dec. 2023
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 Mechanical Engineering (Major 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 and Honors

1. First place in INFORMS OR/MS Mini-Poster Competition   Nov. 2023
   For the paper "Asymmetric certified robustness via feature-convex neural networks."

2. NeurIPS Scholar Award   Oct. 2023

3. DEFINE Program Participant, Duke University   Oct. 2023
Selective future faculty workshop emphasizing socially engaged academic leadership.

4. Rising Star in Mechanical Engineering   Oct. 2023
Selected for commitment to building an equitable and diverse scholarly environment through research, teaching, and service.

5. 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."

6. Mechanical Engineering Summer Fellowship, UC Berkeley   May 2023

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

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

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

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

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

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

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

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

15. ICINCO Best Student Paper Award Shortlisted Candidate   Jun. 2018
For the paper "Quantitative assessment of robotic swarm coverage."

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

Publications * indicates co-first author and equal contribution.

[1] **B. G. Anderson**, S. Sojoudi, and M. Arcak, "Evolutionary games on infinite strategy sets: Convergence to Nash equilibria via dissipativity," *Under review at IEEE Transactions on Automatic Control (TAC)*, 2023. URL: https://brendon-anderson.github.io/files/publications/anderson2023dissipativity.pdf.

[2] **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 at Journal of Machine Learning Research (JMLR)*, 2023. URL: https://arxiv.org/pdf/2101.09306.pdf.

[3] Y. Bai, **B. G. Anderson**, A. Kim, and S. Sojoudi, "Improving the accuracy-robustness trade-off of classifiers via adaptive smoothing," *Under review at*

SIAM Journal on Mathematics of Data Science (SIMODS), 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.

[4] S. Pfrommer*, **B. G. Anderson***, J. Piet, and S. Sojoudi, "Asymmetric certified robustness via feature-convex neural networks," in *Advances in Neural Information Processing Systems (NeurIPS)*, 2023. **First place in INFORMS OR/MS Tomorrow Mini-Poster Competition**.

[5] S. Pfrommer, **B. G. Anderson**, and S. Sojoudi, "Projected randomized smoothing for certified adversarial robustness," *Transactions on Machine Learning Research (TMLR)*, 2023. **INFORMS Data Mining Best Student Paper Award Runner-Up**.

[6] **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.

[7] 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.

[8] **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.

[9] 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.

[10] **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.

[11] **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**.

[12] **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.

[13] 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.

[14] **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.

[15] **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.

[16] **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.

[17] **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. **Shortlisted candidate for Best Student Paper Award**.

Invited Talks and Poster Presentations		
1.	University of Washington, Seattle, WA	Jan. 2024
	"Provably robust machine learning through structure-aware computation." Department of Applied Mathematics seminar talk.	
2.	INFORMS Annual Meeting, Indianapolis, IN	Oct. 2022
	"Projected randomized smoothing for certified adversarial robustness." Research talk.	
3.	NorCal Control Workshop, UC Santa Cruz, Santa Cruz, CA	June 2022
	"Certified robustness via locally biased randomized smoothing." Research poster presentation.	
4.	Tsinghua-Berkeley Shenzhen Institute, Berkeley, CA	May 2022
	"Robust neural networks." Guest lecture for *Optimization Theory and Machine Learning*.	
5.	INFORMS Annual Meeting, Anaheim, CA	Oct. 2021
	"Data-driven certification of neural networks with random inputs." Research talk.	
6.	Tsinghua-Berkeley Shenzhen Institute, Berkeley, CA	May 2021
	"Robust neural networks." Guest lecture for *Optimization Theory and Machine Learning*.	
7.	University of Michigan, Ann Arbor, MI	Apr. 2021
	"Robust neural networks." Guest lecture for *Advanced Topics in Applied Data Analytics* (IOE 491).	
8.	INFORMS Annual Meeting, National Harbor, MD	Nov. 2020
	"Partition-based convex relaxations for robustness certification of ReLU neural networks." Research talk.	
9.	Conference on Control Technology and Applications, Montréal	Aug. 2020
	"Robustness analysis of neural networks." Tutorial session.	
10.	Institute for Pure and Applied Mathematics, Los Angeles, CA	Aug. 2017
	"Robotic swarm analysis." Research talk.	

Teaching	**REU Mentor — UC Berkeley** <div align=right>Summer 2023</div>

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. *Feedback Control Systems* (EE C128/ME C134) — Spring 2024

2. *Convex Optimization* (EE 227BT) — Fall 2023
   Student ratings: Mean 97.1%, Median 100%, Standard deviation 6.1%.

3. *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%.

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

5. *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. NSF grant proposal co-author, 2023.

2. Reviewer for International Conference on Learning Representations (ICLR), 2023.

3. Reviewer for IEEE Transactions on Automatic Control, 2023.

4. Co-organizer of the 2nd Workshop on Formal Verification of Machine Learning (WFVML), International Conference on Machine Learning (ICML), 2023.

5. Reviewer for Conference on Neural Information Processing Systems (NeurIPS), 2023.

6. Reviewer for Conference on Decision and Control (CDC), 2023.

7. Co-chair of the second morning session, NorCal Control Workshop, 2023.

8. Reviewer for International Conference on Machine Learning (ICML), 2023.

9. Reviewer for Learning for Dynamics and Control Conference (L4DC), 2023.

10. Reviewer for Conference on Neural Information Processing Systems (NeurIPS), 2022.

11. Reviewer for Conference on Decision and Control (CDC), 2022.

12. Organizer and co-chair of the session "Safety and Robustness in Machine Learning," INFORMS Annual Meeting, 2022.

13. Reviewer for IEEE Control Systems Letters, 2022.

14. Reviewer for IEEE Open Journal of Control Systems, 2022.

15. Organizer and co-chair of the session "Robustness of Neural Networks," INFORMS Annual Meeting, 2021.

16. Reviewer for Conference on Decision and Control (CDC), 2021.

17. Reviewer for IEEE Transactions on Automatic Control, 2021.

18. Reviewer for Artificial Intelligence and Statistics Conference (AISTATS), 2020.

19. Reviewer for American Control Conference (ACC), 2020.

20. Chair of the session "Data Analytics," 57th Annual Allerton Conference on Communication, Control, and Computing, 2019.

Outreach

1. Peer Advisor for the Bay Area Graduate Pathways to STEM (GPS) program, hosted by UC Berkeley Engineering and Stanford Engineering, 2023.

2. Graduate Student Mentor for incoming students, hosted by UC Berkeley Mechanical Engineering Graduate Student Council, 2023.

3. 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.

4. Graduate Student Mentor for incoming students, hosted by UC Berkeley Mechanical Engineering Graduate Student Council, 2022.

5. Graduate Student Mentor for incoming students, hosted by UC Berkeley Mechanical Engineering Graduate Student Council, 2021.

6. Peer Advisor for the Bay Area Graduate Pathways to STEM (GPS) program, hosted by UC Berkeley Engineering and Stanford Engineering, 2020.

References

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