Anastasia Bizyaeva

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Positions Held

Cornell University *July 2024 - pres.*
Assistant Professor, Sibley School of Mechanical and Aerospace Engineering

University of Washington *Sep. 2024 – pres.*
Affiliate Assistant Professor, Department of Mechanical Engineering

University of Washington *Oct. 2022 – June 2024*
Postdoctoral Scholar, AI Institute in Dynamic Systems

Education

Princeton University *Sep. 2017 – Sep. 2022*
Doctor of Philosophy in Mechanical and Aerospace Engineering

- Dissertation: *Nonlinear dynamics of multi-agent multi-option belief and opinion formation* ↗
- Doctoral advisor Naomi Ehrich Leonard ↗

University of California, Berkeley *Sep. 2012 – Dec. 2016*
Bachelor of Arts in Physics with a Minor in Mechanical Engineering

Research Interests

My research program explores mathematical connections between collectively intelligent behavior in biological and social systems, and the design of autonomous and artificially intelligent behaviors in engineered teams. Active thrusts include

1. Development of biologically inspired nonlinear control algorithms for distributed decision-making and task allocation in dynamic, uncertain, and communication-limited environments;
2. Dynamic modeling and analysis of collective behavior in human social networks and biological swarms;
3. Development and analysis of computational methods for data-driven modeling and forecasting of complex dynamical systems, with a special interest in incorporating domain knowledge including physics, network structure, stochasticity, hidden variables, and constraints characteristic of biological swarms.

Selected Honors and Awards

2022, Simons Postdoctoral Fellowship Award, NSF-Simons Center, Harvard University (offered, declined)
2021, Princeton School of Engineering and Applied Science Award for Excellence
2019, Larisse Rosentweig Klein Memorial Prize, Princeton University
2019, National Science Foundation Graduate Research Fellowship
2019, Ford Foundation Predoctoral Fellowship Competition Honorable Mention
2018, Howard Crathorne Phillips Fellowship in Mechanical Engineering, Princeton University
2017, Gordon Y.S. Wu Fellowship in Engineering, Princeton University
2017, Student Service Award, UC Berkeley Physics

Publications

Journal papers

[J9] A. **Bizyaeva**, A. Franci, and N. E. Leonard, "Multi-topic belief formation through bifurcations over signed social networks ↗," *IEEE Transactions on Automatic Control*, 2024, in press

[J8] N. E. Leonard, A. **Bizyaeva**, and A. Franci, "Fast and flexible multiagent decision-making ↗," *Annual Review of Control, Robotics, and Autonomous Systems*, vol. 7, no. Volume 7, 2024, pp. 19–45, 2024

[J7] S. Musslick and A. **Bizyaeva**, "Examining cognitive flexibility and stability through the lens of dynamical systems ↗," *Current Opinion in Behavioral Sciences*, vol. 57, p. 101375, 2024

[J6] A. **Bizyaeva**, A. Franci, and N. E. Leonard, "Nonlinear opinion dynamics with tunable sensitivity ↗," *IEEE Transactions on Automatic Control*, vol. 68, no. 3, pp. 1415–1430, 2023

[J5] A. Franci, M. Golubitsky, I. Stewart, A. **Bizyaeva**, and N. E. Leonard, "Breaking indecision in multiagent, multioption dynamics ⬀," *SIAM Journal on Applied Dynamical Systems*, vol. 22, no. 3, pp. 1780–1817, 2023

[J4] A. **Bizyaeva**, G. Amorim, M. Santos, A. Franci, and N. E. Leonard, "Switching transformations for decentralized control of opinion patterns in signed networks: application to dynamic task allocation ⬀," *IEEE Control Systems Letters*, vol. 6, pp. 3463–3468, 2022

[J3] S. Park, A. **Bizyaeva**, M. Kawakatsu, A. Franci, and N. E. Leonard, "Tuning cooperative behavior in games with nonlinear opinion dynamics ⬀," *IEEE Control Systems Letters*, vol. 6, pp. 2030–2035, 2022

[J2] N. E. Leonard*, K. Lipsitz*, A. **Bizyaeva****, A. Franci**, and Y. Lelkes**, "The nonlinear feedback dynamics of asymmetric political polarization ⬀," *Proceedings of the National Academy of Sciences*, vol. 118, no. 50, 2021

[J1] A. Franci, A. **Bizyaeva**, S. Park, and N. E. Leonard, "Analysis and control of agreement and disagreement opinion cascades ⬀," *Swarm Intelligence*, vol. 15, no. 1, pp. 47–82, 2021

Peer-reviewed conference papers

[C10] Y. Xing, A. **Bizyaeva**, and K. H. Johansson, "Learning communities from equilibria of nonlinear opinion dynamics ⬀," in *IEEE Conference on Decision and Control*, 2024, to appear

[C9] T. Paine, A. **Bizyaeva**, and M. R. Benjamin, "Adaptive bias for dissensus in nonlinear opinion dynamics with application to evolutionary division of labor games ⬀," in *IEEE Conference on Decision and Control*, 2024, to appear

[C8] P. Gupta, A. **Bizyaeva**, and R. Banavar, "Estimates on the domain of validity for Lyapunov-Schmidt reduction ⬀," in *IEEE Conference on Decision and Control*, 2024, to appear

[C7] A. Brondetta, A. **Bizyaeva**, M. Lucas, G. Petri, and S. Musslick, "On the benefits of heterogeneity in cognitive stability and flexibility for collaborative task switching ⬀," in *Proceedings of the Annual Meeting of the Cognitive Science Society*, vol. 46, 2024

[C6] A. **Bizyaeva***, M. O. Arango*, Y. Zhou, S. Levin, and N. E. Leonard, "Active risk aversion in SIS epidemics on networks ⬀," in *American Control Conference*, pp. 4428–4433, IEEE, 2024

[C5] A. **Bizyaeva**, A. Franci, and N. E. Leonard, "Sustained oscillations in multi-topic belief dynamics over signed networks ⬀," in *American Control Conference*, pp. 4296–4301, 2023

[C4] A. **Bizyaeva**, T. Sorochkin, A. Franci, and N. E. Leonard, "Control of agreement and disagreement cascades with distributed inputs ⬀," in *IEEE Conference on Decision and Control*, pp. 4994–4999, 2021

[C3] A. **Bizyaeva**, A. Matthews, A. Franci, and N. E. Leonard, "Patterns of nonlinear opinion formation on networks ⬀," in *American Control Conference*, pp. 2739–2744, 2021

[C2] L. Rosendahl, A. S. **Bizyaeva**, and J. Cohen, "A novel quantum approach to the dynamics of decision making ⬀," in *Proceedings of the 42nd annual meeting of the Cognitive Science Society*, 2020

[C1] S. Musslick, A. **Bizyaeva**, S. Agaron, N. E. Leonard, and J. D. Cohen, "Stability-flexibility dilemma in cognitive control: a dynamical system perspective ⬀," in *Proceedings of the 41st annual meeting of the Cognitive Science Society*, 2019

Peer-reviewed extended conference abstracts

[A1] C. Cathcart, S. Park, A. **Bizyaeva**, and N. E. Leonard, "Robot navigation around oncoming movers using bio-inspired opinion dynamics," in *International Conference on Intelligent Robots and Systems, workshop on robotics-inspired biology*, 2020

Under review and in preparation

[1] R. Moreno-Morton, A. **Bizyaeva**, N. E. Leonard, and A. Franci, "Multi-agent decision-making with modulatory interactions," *under review*, 2024

[2] A. **Bizyaeva**, D. Tretiak, S. L. Brunton, and J. N. Kutz, "On the importance of timescale in reservoir computing," *in prep*

[3] D. Tretiak, A. **Bizyaeva**, S. L. Brunton, and J. N. Kutz, "Physics-constrained forecasting of spatiotemporal systems with reservoir computing," in *in prep*

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* or ** indicates equal contribution by the authors

[4] M. O. Arango, A. **Bizyaeva**, S. Levin, and N. E. Leonard, "Opinion-driven risk perception and reaction in sis epidemics," in *under review*

[5] A. **Bizyaeva**, U. Fasel, S. L. Brunton, and J. N. Kutz, "Stochastic integral-form sparse model selection," *in prep*

[6] A. **Bizyaeva**, D. Gorbonos, N. E. Leonard, and I. D. Couzin, "From spatial decision-making to nonlinear opinion dynamics," *in prep*

Professional Service

Reviewer

Journals: IEEE Transactions on Automatic Control, IEEE Transactions on Control of Network Systems, IEEE Control Systems Letters, Automatica, IEEE Transactions on Robotics, SIAM Journal on Applied Dynamical Systems, Proceedings of the National Academy of Sciences of the USA, IEEE Transactions on Signal Processing, Journal of the Royal Society Interface, Systems and Control Letters, Nature Scientific Reports

Conference and workshop proceedings: IEEE Conference on Decision and Control, American Control Conference, IEEE International Symposium on Multi-Robot and Multi-Agent Systems, IEEE International Conference on Robotics and Automation, IFAC Workshop on Lagrangian and Hamiltonian Methods for Nonlinear Control, IFAC Workshop on Cyber-Physical & Human-Systems

Committee service

IEEE Control Systems Society: activities officer and founding member (2024-pres.), New and Early career researchers, eXaminers, and invesTigators (NEXT) Committee ↗

- Organized special sessions for early career researchers at 2024 European Control Conference, 2024 American Control Conference, 2024 IEEE Conference on Decision and Control, and virtual 2024 IEEE Control Systems Society Day

Princeton University: Climate and Inclusion Committee Member, Department of Mechanical and Aerospace Engineering (2019-2021); Princeton School of Engineering an Applied Science Diversity and Inclusion Advisory Committee Member (2021-2022)

UC Berkeley: student member of Reading Room Planning Committee (2014-2015); Major Course Committee, Service Course Committee, and Physics Chair Advisory Committee Against Sexual Harassment (2015-2016)

Conferences, Workshops, and Summer Schools

Course organizer, one-week course on "Fast and Flexible Multi-agent Decision Making" at the European Embedded Control Institute International Graduate School on Control (EECI-IGSC) ↗, Liége, Belgium	2025
Program Committee Member, 7th Annual Learning for Dynamics & Control Conference (L4DC) ↗, Ann Arbor, Michigan	2025
Organizer, full-day workshop on "Leveraging bifurcations for control of intelligent and collective behaviors" ↗ at IEEE Conference on Decision and Control, Milan, Italy	2024
Organizing Committee Member, workshop on "Creative Convergence: at the Crossroads of Dance, Ecology, Neuroscience, and Control Engineering" ↗ at Princeton University,	2023

Invited Conference Session Organization

Minisymposium on "Data-driven modeling for complex systems: structure, robustness, and cross-disciplinary applications" at SIAM Conference on Applications of Dynamical Systems, Denver, CO	2025
Minisymposium on "Collective decisions and entropy in data-driven optimization landscapes" at SIAM Conference on Optimization, Seattle, WA	2023
Invited session on "Dynamics of social networks" at IEEE Conference on Decision and Control, virtual	2021
Minisymposium on "Collective behaviour in biological and biologically inspired systems" at SIAM Conference on Applications of Dynamical Systems, virtual	2021

Presentations & Tutorials

Invited Seminars

Scientific Computing and Numerics (SCAN) Seminar, Cornell University	Nov. 2024
Center for Applied Mathematics Colloquium short talk, Cornell University	Oct. 2024
Semiautonomous Seminar[†], Electrical Engineering and Computer Science, UC Berkeley	Oct. 2024
Women in Network Science (WiNS) Seminar[†], Dartmouth College	Sep. 2024
Dept. of Mechanical Engineering, University of Washington	Apr. 2024
Ann and H.J. Smead Dept. of Aerospace Engineering Sciences, CU Boulder	Apr. 2024
BioMath Seminar[†], Virginia Commonwealth University	Mar. 2024
Santa Fe Institute Seminar, Santa Fe, New Mexico	Mar. 2024
Sibley School of Mechanical and Aerospace Engineering, Cornell University	Mar. 2024
Elmore Family School of Electrical and Computer Engineering, Purdue University	Mar. 2024
Dept. of Electrical and Computer Engineering, University of Illinois Urbana-Champaign	Feb. 2024
Dept. of Mechanical Engineering[†], Columbia University	Jan. 2024
Applied Math Seminar, Montana State University	Nov. 2023
Network Dynamics and Control Seminar Series, Linköping University, Sweden	Sep. 2023
KTH Royal Institute of Technology, Stockholm, Sweden	Sep. 2023
Control Seminar, Uppsala University, Uppsala, Sweden	Sep. 2023
MathBio Seminar[†], University of Iowa	Dec. 2023
ControlX Seminar, University of Washington	Feb. 2023

Conference and Workshop Presentations

Workshop on Spreading on Social Networks – Theory and Applications[‡], Center for Discrete Mathematics and Theoretical Computer Science, Rutgers University	Oct. 2024
SIAM Conference on the Life Sciences[‡], Portland, OR	June 2024
APS March Meeting[‡], Minneapolis, MN	June 2024
Workshop on Geometrically Guided Analysis and Design in Optimization and Control[†], Nanyang Technological University, Singapore	Dec. 2023
Dynamical Systems in the Life Sciences Satellite Workshop, Columbus, Ohio	July 2023
Santa Fe Institute Collective Intelligence Symposium[††], Santa Fe, New Mexico	June 2023
American Control Conference, San Diego, California	June 2023
SIAM Conference on Applications of Dynamical Systems[‡], Portland, Oregon	May 2023
"From individual to group decision making: experiments and theory" Workshop[‡] at the Weizmann Institute of Science, Israel	May 2023
IEEE Conference on Decision and Control, Cancún, Mexico	Dec. 2022
3rd Workshop on Mental Effort[‡], Carney Institute for Brain Science, Brown University	Nov. 2022
IEEE Conference on Decision and Control[†‡]	Dec. 2021
2nd Workshop on Mental Effort[†‡]	Sep. 2021
American Control Conference[†]	May 2021
SIAM Conference on Applications of Dynamical Systems[†‡]	May 2021
UCLA IPAM, Mathematical Challenges and Opportunities for Autonomous Vehicles Program, Workshop IV: Social Dynamics beyond Vehicle Autonomy[‡,††]	Nov. 2020
SIAM Conference on the Life Sciences[†‡]	July 2020
52nd Annual Meeting of the Society for Mathematical Psychology[††], Montreal, Canada	July 2019
SIAM Conference on Applications of Dynamical Systems[‡], Snowbird, Utah	May 2019

[†] virtual; [‡] invited; [††] poster