Hans Matthew Riess

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Education

Doctor of Philosophy *Aug 2017 - Oct 2022*

Department of Electrical & Systems Engineering, University of Pennsylvania

Thesis: "Lattice Theory in Multi-Agent Systems" (advisor, Robert Ghrist)

Bachelor of Science *Aug 2013 - May 2017*

Department of Mathematics, Duke University

Academic Appointments

Research Scientist II *Feb 2025 - Present*

Department of Electrical and Computer Engineering, Georgia Institute of Technology

Control, Optimization, Robotics Engineering Lab (director, Mathew Hale)

Postdoctoral Associate *Nov 2022 - Feb 2025*

Department of Electrical and Computer Engineering, Duke University

Autonomous Systems Lab (director, Michael M. Zavlanos)

Adjunct Instructor *Aug 2024 - Dec 2024*

Department of Mathematics, College of Charleston

Teaching

- Elementary Statistics, College of Charleston, Instructor (Fall 2024).
- Video Production for Mathematics, University of Pennsylvania, Teaching Assistant (Fall 2021).
- Fuzzy Type Theory for Opinion Dynamics, The Adjoint School, Teaching Assistant (2022).
- Intro. to Probability & Statistics, University of Pennsylvania, Teaching Assistant (Summer 2018).

Journal Publications

- *Robert Ghrist, Miguel Lopez, Paige Randall North, **Hans Riess**, (2025) "Categorical Diffusion of Weighted Lattices", submitted to *Foundations of Computational Mathematics*.
- Claudio Battiloro, Zhiyang Wang, Hans Riess, Paolo Di Lorenzo, A. Ribeiro, (2024) "Tangent bundle convolutional learning: from manifolds to cellular sheaves and back", *IEEE Transactions on Signal Processing*.
- *Robert Ghrist, Hans Riess, (2022) "Cellular sheaves of lattices and the Tarski Laplacian", *Homotopy Homology, & Applications, 24*(1), 325-345.
- *Michael Cantazaro, Justin Curry, Janis Lazovskis, Greg Malen, Hans Riess, Bei, Wei, Michael Zabka, (2020) "Moduli spaces of Morse functions for persistence", *Applied & Computational Topology*, *4*(3), 353-385.

Conference Proceedings

- Xenia Konti, Hans Riess, Manos Giannopoulos, Yi Shen, Michael J. Pencina, Nicoleta J. Economou-Zavlanos, Michael M. Zavlanos, (2024) "Distributionally robust clustered federated learning: a case study in healthcare", to appear in *63rd IEEE Conference on Control and Decision Systems (CDC)*, Milan.
- Hans Riess, Gregory Henselman-Petrusek, Michael Munger, Robert Ghrist, Zachary Bell, Michael Zavlanos, (2024) "Network preference dynamics using lattice theory", in *2024 American Control Conference*, Toronto.
- Mikhail Hayhoe, Hans Riess†, Michael Zavlanos, Victor Preciado, Alejandro Ribeiro, (2023) "Transferable hypergraph neural networks via spectral similarity", in *Second Machine Learning on Graphs Conference,* virtual.
- Hans Riess, Michael Munger, Michael Zavlanos, (2023) "Max-plus synchronization in decentralized trading systems", in *62st IEEE Conference on Control & Decision Systems (CDC),* Singapore.
- Claudio Battiloro, Zhiyang Wang, Hans Riess, Paolo Di Lorenzo, Alejandro Ribeiro, (2023) "Tangent bundle filters and neural networks: from manifolds to cellular sheaves and back", proceedings of *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP),* Rhodes Island, Greece.
- Hans Riess, Robert Ghrist, (2022) "Diffusion of information on networked lattices by gossip", in *61st IEEE Conference on Control & Decision Systems (CDC)*, Cancun, Mexico.
- Hans Riess, Yiannis Kantaros, George Pappas, Robert Ghrist, (2021) "A temporal-logic based hierarchical network connectivity controller", in *2021 SIAM Control Theory Conference,* virtual.

*Authors listed alphabetically.

†Equal contribution.

Workshop

- Hans Riess, Jakob Hansen, (2020) "Multidimensional persistence module classification via lattice-theoretic convolutions", *34th Neural Information Processing Systems (NeurIPS),* Workshop on Topological Data Analysis and Beyond, virtual.

Preprint

- Hans Riess, Manolis Veveakis, and Michael M. Zavlanos, (2024) "Path Signatures and Graph Neural Networks for Slow Earthquake Analysis: Better Together?" *arXiv preprint arXiv:2402.03558.*
- Alejandro Parada-Mayorga, Hans Riess, Robert Ghrist, Alejandro Ribeiro (2020), "Quiver signal processing", *arXiv preprint arXiv:2010.11525*.

Invited Talks

- "Towards categorical diffusion," Toposes in Mondovi, Grothendieck Institute (September 2024; Mondovi, Italy).
- "Algebraic foundations of planning in multi-agent systems," 2024 Joint Mathematics Meeting (JMM), AMS Special Session on Applied Topology: Theory, Algorithms, and Applications (January 2024; San Francisco, CA).
- "Synchronizing tasks in multi-agent systems with max-plus algebra," Assured Autonomy in Contested Environments (AACE) program review,, Air Force Office of Scientific Research (AFSOR) (December 2023; Durham, NC).
- "Solutions of lattice diffusion equations and applications," Yu Group, Department of Statistics, University of California Berkeley (October 2023; online).
- "Negotiating tasks in multi-agent systems with max-plus algebra", Science of Autonomy, Office of Naval Research (ONR) annual program review (August 2023; Alexandria, Virginia).
- "Social information: perspectives from max-plus algebra and lattice theory", Socio-Mathematics Program Review (BRO-SOMAII), US Department of Defense Basic Research Office (April 2023; Arlington, Virginia).
- "The Tarski Laplacian and beyond", University of Florida Topological Data Analysis Conference (February 2023; Gainesville, Florida).
- "Lattice theory in social choice and multi-agent systems", Applications of Hodge Theory on Networks, Banff International Research Station for Mathematical Innovation and Discovery (February 2023; Banff, Alberta, Canada).
- "Towards geometry of lattice-valued sheaves", Topology Geometry, & Data Analysis Seminar, Ohio State University (November 2022; Columbus, Ohio).
- "Lattice-valued network sheaves", Conference on Applied, Combinatorial, and Toric Topology (July 2022; online).
- "A sheaf Laplacian for lattice-valued sheaves", CIMAT Applied Geometry and Topology Seminar (June 2022; online).

- "Cellular sheaves of lattices and the Tarski Laplacian", 2022 Joint Mathematics Meeting (JMM), AMS Special Session on Statistics and Machine Learning Using Topology and Geometry, (April 2022; online).
- "Lattices and metapreference", Socio-Mathematics Program Review (BRO-SOMAII), US Department of Defense Basic Research Office (April 2022; Arlington, Virginia).
- "Semantics and syntactics", Socio-Mathematics Program Review (BRO-SOMAII), US Department of Defense Basic Research Office (April 2022; Arlington, Virginia).
- "Lattice theory in multi-agent systems", Workshop on Algebraic Combinatorics and Category Theory in Topological Data Analysis (March 2022; online).
- "Network sheaves valued in categories of adjunctions", Applied Category Theory Conference (July 2021; online).
- "A lattice-theoretic Laplacian for cellular sheaves", SIAM Computational Science and Engineering Conference (July 2021; online).
- "Tarski sheaves", Applied Topology in Albany Seminar (February 2021; online).
- "Cellular sheaves and the Tarski Laplacian", Quantum Group Seminar, University of Oxford (July 2020; online).
- "Cellular sheaves and the Tarski Laplacian", SIAM Mathematics of Data Science Conference (May 2020; online).

Service

- Cochair, Game Theory I Session, 2023 IEEE Conference on Decision and Control (CDC).
- Peer review, SIAM Journal of Applied and Computational Geometry.
- Peer review, IEEE Transactions on Automatic Control.
- Peer review, Neural Information Processing Systems (NeurIPS).
- Organizer, GRASP Lab Game Theory Seminar.
- Organizer, Graduate Research Seminar in Applied Topology.
- Volunteer, Duke Alumni Admissions Advisory Committee.