Hans Matthew Riess

Applied Mathematician & Engineer

MACHINE LEARNING, AUTONOMY, APPLIED ALGEBRA, & APPLIED TOPOLOGY

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EDUCATION

Doctor of Philosophy **2017-2022**

Department of Electrical & Systems Engineering, University of Pennsylvania

THESIS: "LATTICE THEORY IN MULTI-AGENT SYSTEMS"; ADVISOR: ROBERT GHRIST

Bachelor of Science **2013-2017**

Department of Mathematics, Duke University

ACADEMIC APPOINTMENTS

Postdoctoral Associate **2022 -**

Department of Electrical and Computer Engineering, Duke University

AWARDS & FELLOWSHIPS

Legget Family Endowed Fellowship, University of Pennsylvania **2018**
Ganster Fellowship, University of Pennsylvania **2017**

REFEREED-PUBLICATIONS

1. C. Battiloro, Z. Wang, H. Riess, P. Di Lorenzo, A. Ribeiro, (2023) "Tangent bundle convolutional learning: from manifolds to cellular sheaves and back", submitted to *IEEE Transactions on Signal Processing.*
2. R. Ghrist, H. Riess, (2022) "Cellular sheaves of lattices and the Tarski Laplacian", *Homotopy Homology, & Applications, 24*(1), 325-345.
3. M. Cantazaro, J. Curry, J. Lazovskis, G. Malen, H. Riess, B, Wei, M. Zabka, (2020) "Moduli spaces of Morse functions for persistence", *Applied & Computational Topology*, *4*(3), 353-385.

Conference Proceedings

1. M. Hayhoe, H. Riess, M. Zavlanos, V. Preciado, A. Ribeiro, (2023) "Transferable hypergraph neural networks via spectral similarity", submitted.
2. H. Riess, M. Munger, M. Zavlanos, (2023) "Max-plus synchronization in decentralized trading systems", to appear in proceedings of *62st IEEE Conference on Control & Decision Systems (CDC)*.
3. C. Battiloro, Z. Wang, H. Riess, P. Di Lorenzo, A. Ribeiro, (2022) "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).*
4. H. Riess, R. Rhrist, (2022) "Diffusion of information on networked lattices by gossip", proceedings of *61st Conference on Control & Decision Systems (CDC).*
5. H. Riess, Y. Kantaros, G. Pappas, R. Ghrist, (2021) "A temporal-logic based hierarchical network connectivity controller", proceedings of *2021 SIAM Control Theory Conference.*

Preprint/non-Archival

1. H. Riess, J. Hansen, (2020) "Multidimensional persistence module classification via lattice-theoretic convolutions", *34th Neural Information Processing Systems (NeurIPS),* Workshop on Topological Data Analysis and Beyond.
2. A. Parada-Mayorga, H. Riess, A. Ribeiro, R. Ghrist, (2020), "Quiver signal processing", *arXiv preprint arXiv:2010.11525*.

Invited Talks

- "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 annual program review (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", 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).

COURSES TAUGHT

- "Video Production for Mathematics", Univ. of Pennsylvania, Teaching Assistant (Fall 2021).
- "Introduction to Probability & Statistics", U. Penn., Teaching Assistant (Summer 2018).

SERVICE

- 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.