

JOHANNES CHRISTOPH MÜLLER^{ID}

PERSONAL DATA

Pronouns: He/him

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EDUCATION

- PhD in Mathematics, *MPI MiS & Leipzig University*, Germany, *Summa cum laude* 2020–2024
- M.Sc. in Mathematics, *University of Freiburg*, Germany, *Grade 1.0* 2016–2019
- M.Sc. in Interdisciplinary Mathematics, *University of Warwick*, UK, *With distinction* 2017–2018
- B.Sc. in Mathematics, *University of Freiburg*, Germany, *Grade 1.1* 2013–2016

EMPLOYMENT

- RWTH Aachen University, Aachen, Germany 09/2023–09/2024
- Max-Planck Institute for Mathematics in the Sciences, Leipzig, Germany 01/2020–08/2023

RESEARCH INTERESTS

- Interplay between geometry and optimization in scientific machine learning and reinforcement learning
- Geometry of probability measures, information geometry, algebraic statistics
- Neural network based numerical solvers for partial differential equations
- Neural network approximation theory

TEACHING EXPERIENCE

AS TEACHING ASSISTANT

- Seminar on *Neural network approximation theory* 2024
- Mathematical Foundations of Deep Learning 2023/2024

AS TUTOR

- Analysis I&II 2018–2019
- Linear Algebra, Measure and Integration Theory, Functional Analysis 2015–2017

SUPERVISION

- Reza Zolnouri, Master thesis in Mathematics 2024
The Role of the Geometry in Policy Mirror Descent
- Jonas Nießen, Master thesis in Mathematics 2023/2024
Optimization guarantees for Physics-Informed Neural Networks
- Friedrich Wicke, Undergraduate intern in Mathematics 2022
State-Action Geometry of Multi-Agent Problems

GRANTS AND AWARDS

- SIAM Travel award (\$800) 2022
- PhD Scholarship, Evangelisches Studienwerk Villigst e.V. (~€50k) 2021–2023
- International Max Planck Research School for Mathematics in the Sciences, MPI MiS 2020–2023
- Scholarship, Evangelisches Studienwerk Villigst e.V. (~€30k) 2015–2019

PROFESSIONAL SERVICES

REVIEWING SERVICES

- Science Advances
- Engineering Applications of Artificial Intelligence
- SIAM Journal on Mathematical Analysis
- International Conference on Machine Learning
- International Conference on Learning Representations
- IEEE Transactions on Automatic Control
- Transactions on Machine Learning Research
- Information Geometry

NON SCIENTIFIC SERVICES

- Member of the Promovierendeninitiative (Nationwide council of PhD scholarship holders) 2021–2023
- External PhD representative, Max Planck Institute for Mathematics in the Sciences 2021–2022
- Summer school student organisational committee, Evangelisches Studienwerk Villigst e.V. 2018–2019

RELEVANT SKILLS

LANGUAGES German (Mother tongue), English (full working proficiency), French (basic skills)

PROGRAMMING Julia, Python, R, Mathematica

PUBLICATIONS AND PREPRINTS

PRESENTATIONS

TALKS

- *Geometry and Convergence of Natural Policy Gradient Methods* 06/2024
Seminar on Learning Theory and Statistical Optimization, University of Oxford

- *Geometry of Optimization in Scientific Machine Learning and Reinforcement Learning* 06/2024
Invited talk, Geometric Deep Learning workshop, University of Cambridge
- *Achieving High Accuracy with PINNs via Energy Natural Gradient Descent* 06/2024
PhysicsX, London
- *Natural Gradients for Scientific Machine Learning* 01/2024
Post Graduate Seminar, Chair of Mathematics of Information Processing, RWTH Aachen
- *Theoretical Analysis of Boundary Penalties for NN-based PDE Solvers* 04/2023
Machine Learning + X Seminars 2023, Brown University, Providence, online
- *Geometry of Sequential Decision Problems* 02/2023
Optimization and Data Science Seminar, University of California, San Diego, online
- *Geometry of Natural Policy Gradient Methods* 10/2022
Applied Math Colloquium, University of California, Los Angeles
- *The Geometry of Memoryless Stochastic Policy Optimization in Infinite-Horizon POMDPs* 09/2022
Minisymposium on Algebraic Geometry and Machine Learning, SIAM Conference on Mathematics of Data Science
- *From Markov Decision Processes to Algebraic Statistics* 08/2022
Workshop on Algebraic Geometry, Combinatorics and Machine Learning, MPI MiS, Leipzig
- *The Geometry of Sequential Decision Problems with State Uncertainty* 05/2022
Algebraic Statistics 2022, University of Hawai'i at Manoa, Honolulu
- *Deep Ritz Revisited* 04/2020
Math Machine Learning seminar MPI MIS + UCLA

POSTER

- *Essentially Sharp Estimates on the Entropy Regularization Error in Discounted Markov Decision Processes* 07/2024
Workshop on Foundations of RL and Control, ICML, Wien
- *Position: Optimization in SciML Should Employ the Function Space Geometry* 07/2024
Forty-first International Conference on Machine Learning, Wien
- *Fisher-Rao Gradient Flows of Linear Programs and State-Action Natural Policy Gradients* 02/2024
Symposium on Sparsity and Singular Structures 2024, RWTH Aachen University
- *Geometry and Convergence of Natural Policy Gradient Methods* 02/2024
Symposium on Sparsity and Singular Structures 2024, RWTH Aachen University
- *Geometry and Convergence of Natural Policy Gradient Methods* 01/2024
Mini-Workshop on Reinforcement Learning, University of Mannheim
- *Solving infinite-horizon POMDPs with memoryless stochastic policies in state-action space* 06/2022
Multidisciplinary Conference on Reinforcement Learning and Decision Making, Brown University
- *The Geometry of Memoryless Stochastic Policy Optimization in Infinite Horizon Partially Observable Markov Decision Processes* 04/2022
International Conference of Learning Representations, online
- *A Posteriori Estimates and Convergence Guarantees for Neural Network Based PDE solvers* 11/2021
Deep learning and partial differential equations, Sir Isaac Newton Institute, Cambridge, online
- *The Geometry of Memoryless Stochastic Policy Optimization in Infinite Horizon Partially Observable Markov Decision Processes* 10/2021
Geometry & Learning from Data, BIRS workshop hosted by Casa Matemática Oaxaca (CMO), online
- *The geometry of discounted stationary distributions of Markov decision processes* 08/2021
Workshop on Mathematics of Deep Learning, Sir Isaac Newton Institute, Cambridge, online
- *The geometry of discounted stationary distributions of Markov decision processes* 08/2021
Conference on Mathematics of Machine Learning, Zentrum für interdisziplinäre Forschung, Bielefeld
- *On the space-time expressivity of ResNets* 04/2020
ICLR workshop on Integration of Deep Neural Models and Differential Equations, online
- *Deep Ritz Revisited* 04/2020
ICLR workshop on Integration of Deep Neural Models and Differential Equations, online

OUTREACH ACTIVITIES

- Panel discussion on *Excellence and Ethics in Science and Academia* 2023
75-th anniversary ceremonial act of the Evangelisches Studienwerk Villigst e.V.
- One-week Seminar *Alpha Go – oder: Vom besiegten Menschen* 2019
Annual Summer School of the Evangelisches Studienwerk Villigst e.V.

ACADEMIC REFERENCES

- Professor Dr. Semih Çaycı; contact: `cayci@mathc.rwth-aachen.de`
- Professor Dr. Guido Montúfar; contact: `montufar@math.ucla.edu`