Moritz Willig

Curriculum Vitae

Computer Science Department, Technical University of Darmstadt, Germany

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CONTACT INFORMATION

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SUMMARY & RESEARCH STATEMENT

I am a fifth year PhD candidate at the AIML Lab of Prof. Kristian Kersting at the Technical University of Darmstadt, Germany.

Current foundation models, despite their scale, primarily rely on associational learning methods. Consequently, they are prone to reasoning shortcuts and fallacies, indicating that while they can *simulate* reasoning on the surface, they lack a genuine understanding of the mechanisms driving the processes they reason about. My research goal is to bridge this gap, equipping AI systems with the ability to perform *genuine causal reasoning.*

A full research statement is available at:
https://moritz-willig.de/moritzWilligResearchStatement.pdf

EDUCATION

2021 – 2026 **PhD Candidate**, *AIML Lab, Technical University of Darmstadt, Germany*
AIML Lab: https://www.aiml.informatik.tu-darmstadt.de/

- Advisors: Kristian Kersting, Devendra Singh Dhami

2017 – 2020 **M.Sc. Visual Computing**, *Technical University of Darmstadt, Germany*

- Thesis Supervisors: Stefan Roth, Junhwa Hur
- Thesis: "Analysing and overcoming the dataset bias for optical flow backbone networks"

2013 – 2017 **B.Sc. Computer Science**, *Technical University of Darmstadt, Germany*

- Thesis Supervisors: Christian Bischof, Christian Iwainsky
- Thesis: "Implementation and Evaluation of Coverage and Hot/Coldspot Assertions"

COMMUNITY SERVICE ACTIVITIES

I am a regular reviewer for various international AI and machine learning conferences, journals and workshops. Amongst others: NeurIPS (2024, 2025 *[top reviewer]*), AAAI (2024, 2025), ICLR (2025 *[notable reviewer]*, 2026), ICML (2022, 2025 *[top reviewer]*), AISTATS (2022 *[top reviewer]*, 2024-2026), TMLR (2024-*present*), Conference on Causal Learning and Reasoning (CLeaR; 2025,26).

TALKS

- [Contributed Talk] Winter School on Causality and XAI 2025, Paris. [website] [slides]
  "Beyond Causal Parrots: The Role of Meta-Causality for Genuine Causal Understanding"

PUBLICATIONS The following publications include works at major conferences and workshops. A full list of all publications can be found at: `https://scholar.google.de/citations?user=1EDRWTsAAAAJ`

** indicates co-first authorship*

Moritz Willig, Tim Nelson Woydt, Devendra Singh Dhami and Kristian Kersting. When Causal Dynamics Matter: Adapting Causal Strategies through Meta-Aware Interventions. In *Thirty-ninth Conference on Neural Information Processing Systems (**NeurIPS 2025**)*, 2025. URL `https://openreview.net/forum?id=3fpYXmBiTY`.

Florian Peter Busch, **Moritz Willig**, Matej Zečević, Kristian Kersting and Devendra Singh Dhami. Structural Causal Circuits: Probabilistic Circuits Climbing All Rungs of Pearl's Ladder of Causation. In *Transactions on Machine Learning Research (**TMLR**)*, 2025. URL `https://openreview.net/forum?id=25XyUTICdZ`

Florian Peter Busch, **Moritz Willig**, Matej Zečević, Kristian Kersting, Devendra Singh Dhami. Counterfactual Sum-Product Networks. In *In UAI 2025 Eighth Workshop on Tractable Probabilistic Modeling*, 2025.

Moritz Willig, Tim Nelson Tobiasch, Florian Peter Busch, Jonas Seng, Devendra Singh Dhami and Kristian Kersting. Systems with Switching Causal Relations: A Meta-Causal Perspective. In *The Thirteenth International Conference on Learning Representations (**ICLR 2025**)*, 2025. URL `https://openreview.net/forum?id=J9VogDTa1W`. ***[Spotlight]***.

Florian Peter Busch, **Moritz Willig**, Jonas Seng, Kristian Kersting and Devendra Singh Dhami. Ψnet: Efficient Causal Modeling at Scale. In *International Conference on Probabilistic Graphical Models (**PGM 2024**)*, pages 452–469. PMLR, 2024. URL `https://proceedings.mlr.press/v246/busch24a.html`.

Harsh Poonia, **Moritz Willig**, Zhongjie Yu, Matej Zečević, Kristian Kersting and Devendra Singh Dhami. χSPN: Characteristic Interventional Sum-Product Networks for Causal Inference in Hybrid Domains. In *The 40th Conference on Uncertainty in Artificial Intelligence (**UAI 2024**)*, 2024. URL `https://openreview.net/forum?id=s3kqfH5KBI`.

Moritz Willig, Matej Zečević and Kristian Kersting. "Do Not Disturb My Circles!" Identifying the Type of Counterfactual at Hand. In *Conference on Advances in Robust Argumentation Machines (**RATIO 2024**)*, pages 266–275. Springer, 2024. URL `https://link.springer.com/chapter/10.1007/978-3-031-63536-6_16`.

Anita Keshmirian, **Moritz Willig**, Babak Hemmatian, Kristian Kersting, Ulrike Hahn and Tobias Gerstenberg. Chain Versus Common Cause: Biased Causal Strength Judgments in Humans and Large Language Models. In *Proceedings of the Annual Meeting of the Cognitive Science Society (**CogSci 2024**)*, volume 46, 2024.

Moritz Willig, Matej Zečević, Devendra Singh Dhami and Kristian Kersting. Do Not Marginalize Mechanisms, Rather Consolidate! In *Thirty-seventh Conference on Neural Information Processing Systems (**NeurIPS 2023**)*, 2023. URL `https://openreview.net/forum?id=xBhvMu4J03`.

Matej Zečević*, **Moritz Willig***, Devendra Singh Dhami and Kristian Kersting. Causal Parrots: Large Language Models May Talk Causality But Are Not Causal. *Transactions on Machine Learning Research (**TMLR**)*, 2023. URL `https://openreview.net/forum?id=tv46tCzs83`.

Matej Zečević, **Moritz Willig**, Devendra Singh Dhami and Kristian Kersting. Identifying Challenges for Generalizing to the Pearl Causal Hierarchy on Images. In *ICLR 2023 Workshop on Domain Generalization*, 2023. URL `https://openreview.net/forum?id=QBgmo9BvnS`.

Moritz Willig*, Matej Zečević*, Devendra Singh Dhami and Kristian Kersting. Can Foundation Models Talk Causality? In *UAI 2022 Workshop on Causal Representation Learning*, 2022. URL `https://arxiv.org/abs/2206.10591`.

Johannes Czech, **Moritz Willig**, Alena Beyer, Kristian Kersting and Johannes Fürnkranz. Learning to play the chess variant Crazyhouse above world champion level with deep neural networks and human data. *Frontiers in Artificial Intelligence*, 3:24. Frontiers Media SA, 2020. URL `https://www.frontiersin.org/articles/10.3389/frai.2020.00024/full`.

PREPRINTS

Florian Peter Busch, **Moritz Willig**, Florian Guldan, Kristian Kersting and Devendra Singh Dhami. Tagged for Direction: Pinning Down Causal Edge Directions with Precision. In arXiv preprint arXiv:2506.19459, 2025.

Tim Woydt, **Moritz Willig**, Antonia Wüst, Lukas Helff, Wolfgang Stammer, Constantin A Rothkopf and Kristian Kersting. Fodor and Pylyshyn's Legacy-Still No Human-like Systematic Compositionality in Neural Networks. In arXiv preprint arXiv:2506.01820, 2025.

Nicholas Tagliapietra, Juergen Luettin, Lavdim Halilaj, **Moritz Willig**, Tim Pychynski and Kristian Kersting. CausalMan: A physics-based simulator for large-scale causality. In arXiv preprint arXiv:2502.12707, 2025.

TEACHING I am teaching the course "Causality for AI & ML" in the winter semester 2025/26 at TU Darmstadt as part of the computer science curriculum. Previously, I assisted in a seminar and lecture of the same name in summer 2023 and winter semester 2023/24, respectively.

SUPERVISION I regularly supervise students on the topics of machine learning and causality:

Supervised Bachelor Theses:

2025 "Automatic Consolidation of Structural Causal Models"

2024 "Leveraging Homogeneity in Variable Tagging to Determine Causal Directions." (co-supervision)

2024 "An LSTM Based Beampath Optimizer for the S-DALINAC" (co-supervision)

2023 "Regressing Causal Features Through Structural Causal Models"

2022 "Extracting Causal Graphs from Process Data" (co-supervision)

Supervised Master Theses:

- **2025** "Learning to Adapt to New Environments with Causal-Based Reinforcement Learning"
- **2025** "Investigating Causal Modal Reasoning in Large Language Models"
- **2024** "Failure Mode Detection and Adaption of Causal Models From Single Data Points"
- **2024** "Detecting Charging Fault Patterns in Real-world Automotive Measurement Data"
- **2023** "Causal Abstractions in Intervened Systems"

UNIVERSITY SERVICE ACTIVITIES	**2024**	University Hiring Committee, Voting Member (PhD Representative; 2 committees)

OTHER ACTIVITIES	**2024/25**	Continual Confounding Challenge at Continual Causality Bridge @ AAAI-25 (Co-Organizer). `https://www.continualcausality.com/`