

# RICHARD BORNEMANN

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## RELEVANT RESEARCH EXPERIENCE

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### Student Research Assistant

Jan 2022 - Jul 2022

*Chair of Statistical Learning and Data Science, LMU*

- Developed a framework to leverage learned approximations of Bregman Divergences as data-dependent distance metrics for contrastive self-supervised training of transformer-based models, aimed at improving learned representations for fine-tuning on downstream tasks
- Managed large-scale distributed training and evaluation of the models on the ImageNet and Conceptual Captions datasets

### Student Research Assistant

Dec 2022 - Present

*Chair of Artificial Intelligence and Machine Learning, LMU*

- Contributed to the design and development of Compare-xAI, a comprehensive benchmark for 13 different Explainable AI methods
- Co-authored the Compare-xAI research paper and assisted in the creation of a public website for the benchmark results
- Implemented novel architectures for Bayesian Neural Networks, aimed at improving risk certificates for predictive performance on out-of-distribution datasets
- Trained and evaluated the models across a range of PAC-Bayes bounds for self-certified training

### Research Intern

Apr 2023 - Sep 2023

*INRIA Bordeaux FLOWERS Laboratory*

- Led research efforts on the emergence of open-ended cooperative exploration behaviors in decentralized multi-agent meta-learning settings
- Created a multi-agent meta-learning environment featuring an open-ended task space
- Developed a novel approach to train agents in single-and multi-agent scenarios simultaneously using decentralized PPO, improving individual agent performance by up to 50% over agents trained only in multi-agent settings
- Presented findings as the first author at the NeurIPS 2023 ALOE Workshop in New Orleans, USA.

### Master's Thesis Student

Mar 2024 - Sep 2024

*Chair of Robotics, Artificial Intelligence and Real-time Systems, Technical University Munich*

- Proposed and conducted research on distilling language-based reasoning from expert data into end-to-end trained language-conditioned visuo-motor policies for robotics
- Created Meta-CALVIN, a novel language-based meta-learning environment for robotics, adapted from the CALVIN environment
- Developed an LLM guided expert to generate rewarding trajectories in Meta-CALVIN to create a dataset for imitation learning
- Trained multiple billion parameter Vision-Language-Action models, coming within 96% of the average reward achieved by the LLM-based expert on the set of evaluation tasks

## EDUCATION

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### University of Münster

Mar 2020

Bachelor of Economics. Final Grade: 2.3

*Thesis Title:* Long-Term Interest Rate Movements in Early-Modern Central European Markets

*Advisors:* Prof. Pfister, Dr. Matthias Hartermann

*Grade:* 1.7

### Ludwig-Maximilians-Universität in Munich (LMU)

Sep 2024

Master of Statistics. Final Grade: 1.28

*Thesis Title:* Language Conditioned Meta-Learning for Multi-Manipulation Tasks

*Advisors:* Prof. Alois Knoll, MSc. Xiangtong Yao

*Grade:* 1.0

## PUBLICATIONS

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1. **Richard Bornemann**, Xiangtong Yao, Zhenshan Bing, Huang Kai, and Alois Knoll. Embodied reasoning for language-conditioned meta-learning in multi-manipulation task scenarios. *Preprint*, 2024
2. **Richard Bornemann**, Gautier Hamon, Eleni Nisioti, and Clément Moulin-Frier. Emergence of collective open-ended exploration from decentralized meta-reinforcement learning. *NeurIPS 2023 - Conference on Neural Information Processing Systems / ALOE Workshop*, 2023
3. Mohamed Karim Belaid, **Richard Bornemann**, Maximilian Rabus, Ralf Krestel, and Eyke Hüllermeier. Compare-xai: Toward unifying functional testing methods for post-hoc xai algorithms into a multi-dimensional benchmark. In *Explainable Artificial Intelligence*, pages 88–109, Cham, 2023. Springer Nature Switzerland

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#### RELEVANT KNOWLEDGE

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**Programming Languages:** Python, R

**Developer Tools:** Git, SLURM, Docker, Anaconda

**Frameworks:** Pytorch, PytorchLightning, Numpy, Huggingface, Pandas, PyBullet

**OS:** Windows, Linux

**Languages:** German (native), English (fluent)

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#### RELEVANT COURSEWORK

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Deep Unsupervised Learning, Deep Learning, Deep Learning for Natural Language Processing, Multivariate Statistics, Decision Theory, Predictive Modelling, Generalized Regression, Statistical Inference

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#### INTERESTS

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Formula 1, American Football, Chess, Hiking, Running