

Philipp Becker

MACHINE LEARNING RESEARCHER

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Key Research Expertise

- Using generative AI for world modeling in reinforcement learning and image generation.
- Learning dynamics and representations for robotics from multimodal observations.
- Modeling time series with structured and probabilistic state space models.
- Quantifying uncertainties in deep learning using Bayesian approaches and variational inference.
- Improving reinforcement and imitation learning with information-theoretic methods.

Experience

Research Intern (6 months)

Cambridge, United Kingdom

SAMSUNG R&D INSTITUTE UK, AI CENTER - CAMBRIDGE, GEN AI TEAM

11/2024 - Present

- Trained large-scale generative AI methods for text-to-image using diffusion models across multiple GPUs.
- Explored structured state-space approaches and linear attention as efficient alternatives to self-attention in transformer architectures.

Doctoral Researcher

Karlsruhe & Tübingen, Germany

KARLSRUHE INSTITUTE OF TECHNOLOGY (KIT), AUTONOMOUS LEARNING ROBOTS LAB (SINCE 01/2020)

BOSCH CENTER FOR ARTIFICIAL INTELLIGENCE, ROBERT-BOSCH-GMBH (05/2019-12/2019)

05/2019 - Present

- Published 4 first-author and 11 co-author publications at ICML, ICLR, NeurIPS, TMLR, RLC, RSS, CoRL, IROS, and ICRA.
- Supervised 25+ Bachelor and Master students, often in collaboration with other labs, leading to 8 co-author publications.
- Ensured robust compute availability for efficient research in the lab by setting up and maintaining local GPU resources (SLURM-based cluster, desktop pool), supervising the development of experiment deployment tools, and coordinating with public providers of large-scale compute.
- Demonstrated organizational and problem-solving skills by supporting the establishment of two research labs and ensuring operational continuity during challenges such as the shift to remote lectures during COVID-19 and lab closures and relocations due to infrastructure issues.
- Designed exams and exercises and presented solutions for "Machine Learning - Foundations and Algorithms" (graduate level lecture) as the head teaching assistant for 3 years.
- Guest lectured on model-based reinforcement learning to 50+ students for "Reinforcement Learning" (graduate level lecture).

Research Scientist

Karlsruhe, Germany

FZI RESEARCH CENTER FOR INFORMATION TECHNOLOGY, (FZI FORSCHUNGSZENTRUM INFORMATIK)

04/2023 - 07/2024

- Worked towards establishing a new research group under the direction of Prof. Gerhard Neumann.
- Contributed to securing funding for the EU Horizon project XSCAVE (€8M total, €950K to FZI), focusing on AI-driven planning and control for heavy machinery in industries like forestry and mining.
- Collaborated on research grant proposals with academic and industry partners, focusing on AI for production, energy, and heavy machinery.
- Successfully evaluated structured reinforcement learning approaches for control applications of an industry customer.

Student Researcher

Darmstadt, Germany

TECHNICAL UNIVERSITY OF DARMSTADT, INTELLIGENT AUTONOMOUS SYSTEMS

04/2016 - 04/2019

- Developed a software stack for point cloud-based active segmentation with real and simulated robots in C++ using ROS and PCL.
- Collaborated on robotics projects, including a policy learning toolbox, feasibility studies on real robots, and setting up simulations.

Student Intern

Munich, Germany

'DEEP LEARNING AND ROBOTICS CHALLENGE' AT VOLKSWAGEN GROUP, DATA LAB IN COLLABORATION WITH NVIDIA

09/2017

- Developed a Lego robot with control and deep learning perception stacks, for autonomous deployment on the Lego system and a NVIDIA Jetson.

Education

Ph.D. in Computer Science, Machine Learning (Ongoing)

Karlsruhe, Germany

KARLSRUHE INSTITUTE OF TECHNOLOGY, AUTONOMOUS LEARNING ROBOTS LAB

01/2020 - 06/2025 (Expected)

- Thesis: Learning and Inference with Probabilistic World and Behavior Models for Decision Making and Control.
- Advisor: Gerhard Neumann

Master of Science in Autonomous Systems (Computer Science), with Distinction

Darmstadt, Germany

TECHNICAL UNIVERSITY OF DARMSTADT,

11/2016 - 04/2019

- Thesis: Expected Information Maximization: Using the I-Projection for Mixture Density Estimation.
- Honors: ECTS A Ranking, Deutschlandstipendium (Germany Scholarship), awarded for academic excellence (2016–2019).

Summer Schools

- Nordic Probabilistic AI School, Trondheim, Norway, June 2023
- Machine Learning Summer School, Virtual (Tübingen, Germany), July 2020

First Author Publications**Combining Reconstruction and Contrastive Methods for Multimodal Representations in RL**

RLC

BECKER, P., MOSSBURGER, S., OTTO, F., NEUMANN, G.

2024

KalMamba: Towards Efficient Probabilistic State Space Models for RL under Uncertainty

Workshop, ICML & RLC

BECKER, P., FREYMUTH N., NEUMANN, G.

2024

On Uncertainty in Deep State Space Models for Model-Based Reinforcement Learning

TMLR

BECKER, P., NEUMANN, G.

2022

Expected Information Maximization: Using the I-Projection for Mixture Density Estimation

ICLR

BECKER, P., ARENZ, O., NEUMANN, G.

2020

Recurrent Kalman Networks: Factorized Inference in High-Dimensional Deep Feature Spaces

ICML

BECKER, P., PANDYA, H., GEBHARDT, G., ZHAO, C., TAYLOR, J., NEUMANN, G.

2019

Co-Author Publications (Selected)**Geometry-aware RL for Manipulation of Varying Shapes and Deformable Objects**

Under Review

HOANG, T., LE, H., BECKER, P., ANH NGO, V., NEUMANN, G.

2024

Vlearn: Off-Policy Learning with Efficient State-Value Function Estimation

Under Review

OTTO, F., BECKER, P., ANH NGO, V., NEUMANN, G.

2024

PointPatchRL - Masked Reconstruction Improves Reinforcement Learning on Point Clouds

CoRL

GYENES, B., FRANKE, N., BECKER, P., NEUMANN G.

2024

MuTT: A Multimodal Trajectory Transformer for Robot Skills

IROS

KIENTLE C., ALT B., CELIK O., BECKER P., KATIC D., JÄKEL R., NEUMANN G.

2024

Beyond Deep Ensembles: A Large-Scale Evaluation of Bayesian Deep Learning under Distribution Shift

NeurIPS

SELIGMANN, F., BECKER, P., VOLPP, M., NEUMANN, G.

2023

Accurate Bayesian Meta-Learning by Accurate Task Posterior Inference

ICLR

VOLPP, M., DAHLINGER, P., BECKER, P., DANIEL, C., NEUMANN, G.

2023

Hidden Parameter Recurrent State Space Models For Changing Dynamics Scenarios

ICLR

SHAJ, V., BÜCHLER, D., SONKER, R., BECKER, P., NEUMANN, G.

2022

Specializing Versatile Skill Libraries using Local Mixture of Experts

CoRL

CELIK, O., ZHOU, D., LI, G., BECKER, P., NEUMANN, G.

2021

Differentiable Trust Region Layers for Deep Reinforcement Learning

ICLR

OTTO, F., BECKER, P., ANH NGO, V., ZIESCHE, H., NEUMANN, G.

2021

Action-Conditional Recurrent Kalman Networks For Forward and Inverse Dynamics Learning

CoRL

SHAJ, V., BECKER, P., BUCHLER, D., PANDYA, H., VAN DUIJKEREN, N., TAYLOR, J., HANHEIDE M., NEUMANN, G.

2020

Reviewing**Machine Learning** TMLR, NeurIPS, ICLR, ICML, CoRL, RLC**Robotics** RA-L, IROS, ICRA**Skills****Programming** Python, Java, C++, C, Matlab, Bash/Shell Scripting**ML Frameworks** PyTorch, Tensorflow, Jax, Keras, PyTorch Lightning, multi-GPU/multi-node model training**ML Infrastructure** Git, Slurm, Docker, WandB, TensorBoard, Matplotlib, Pandas, Hydra, Optuna**Robotics** MuJoCo, Mitsubishi PA10, KUKA LBR iiwa, Franka Emika Panda