MARTIN TRAPP

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Education

PhD in Computer Science *(with distinction)* — Nov. 2015 – Aug. 2020
Graz University of Technology, Austria.

Topic: Sum-Product Networks for Complex Modelling Scenarios

My thesis focused on the intersection of Bayesian statistics and a popular family of tractable deep probabilistic models nowadays known as probabilistic circuits. The overarching goal was to utilize synergies between both fields to advance tractable models and their use for complex modelling scenarios, such as time-series data.

MSc in Computational Intelligence (Computer Science) — Oct. 2009 – Jan. 2014
Vienna University of Technology, Austria.

Topic: Automatic Localization of Anatomical Landmarks on Medical Images

BSc in Computer Science — Oct. 2006 – Jun. 2009
University of Applied Sciences Technikum Wien, Austria.

Current Position

Independent Postdoctoral Fellow *Aalto University* — Sep. 2022 – present
↪ Academy of Finland Postdoctoral Fellowship — *Helsinki, Finland*

My research focuses on the development of **scalable and reliable machine-learning** methods with a particular emphasis on **uncertainty quantification & representation** in **deep learning** by leveraging techniques from **probabilistic circuits**. Further, I apply my methodological work in **computer vision** tasks, **large language models**, and **vision-language models**.

Work Experience

Postdoctoral Researcher *Aalto University* — Nov. 2020 – Aug. 2022
↪ Ass.Prof. Arno Solin's group — *Helsinki, Finland*

Topics: Bayesian deep learning, uncertainty quantification, diffusion models
Duties: Machine learning research, guide PhD students, supervise Master students and interns, organise scientific events, seminars, & meetings, publish research results

Research Assistant *University of Cambridge* — Aug. 2018 – Sep. 2018
↪ Prof. Zoubin Gharamani's group — *Cambridge, UK*

Topics: Probabilistic programming, Bayesian statistics, software development
Duties: Develop and optimize codebase, specifically: compiler, particle filter, Bayesian non-parametric models, visualisation tools

Research Assistant (part-time) *Graz University of Technology* — May 2017 – Jul. 2020
↪ Assoc.Prof. Franz Pernkopf's group — *Graz, Austria*

Topics: Sum-product networks, Bayesian deep learning, machine learning
Duties: Machine learning research, publish research results

Research Assistant (part-time) *Austrian Research Institute for AI (OFAI)* — Apr. 2015 – May 2019
↪ Applied Cognitive Sciences group — *Vienna, Austria*

Topics: Applied Bayesian statistics, data mining, applied machine learning
Duties: Support applied projects with machine learning expertise

Research Assistant (part-time) *VRVis Research Center* — Jan. 2009 – Feb. 2015
↪ Biomedical Image Informatics group — *Vienna, Austria*

Topics: Applied machine learning, biomedical image processing, software development
Duties: Development of BrainWarp software, applied reseach in image processing

Research Visits

University of California, Los Angeles (UCLA) in Los Angeles, USA — planned for Apr. 2025
University of British Columbia (UBC) in Vancouver, Canada — Oct. 2023 – Dec. 2023
University of Cambridge in Cambridge, UK — Dec. 2017 – Jan. 2018

Selected Projects

Uncertainty Quantification in Large-Scale Deep Learning Models *Project Lead* — Spring 2024 – ongoing
↪ Papers under review: Baumann et al. [2024], Li et al. [2024] — *Aalto University*

Together with Rui Li, Anton Baumann, and Dr. Marcus Klasson, develop **scalable techniques for uncertainty quantification** in large-scale models. Our work has a particular focus on scaling **Bayesian deep learning**. In our recent arXiv papers (under review at to top-tier venues), we show how to propagate uncertainty in large-scale models without sampling, scaling Bayesian deep learning to **large-language models** and **vision-language models**.

Next Generation Tractable Probabilistic Models *Senior Researcher* — Sept. 2020 – ongoing
↪ Publications: Yu et al. [2023], Loconte et al. [2024] — *Aalto University*

Together with Aleksanteri Sladek, Zhongjie Yu (TU Darmstadt), and Dr. Antonio Vergari (University of Edinburgh), we work on advanced modelling families that allow **exact and efficient probabilistic reasoning**. The latest results have been presented at **NeurIPS 2023** as an oral **(top 1%)** and at **ICLR 2024** as a spotlight **(top 5%)**.

Encoding Meaningful Assumptions in Deep Learning Models *Senior Researcher* — 2020 – 2021
↪ Publication: Meronen et al. [2021] — *Aalto University*

Together with Lassi Meronen and Arno Solin, we investigated inductive biases in deep learning and developed theory showing how to encode conservative behaviour to prevent overconfident predictions. The results have been presented at NeurIPS 2021.

Turing.jl: Universal probabilistic programming in Julia *Core Developer* — Summer 2018
↪ Project page: https://turinglang.org/ — *University of Cambridge*

Together with Hong Ge and Kai Xu, we worked on developing the probabilistic programming language Turing.jl. I contributed to various parts of the codebase and additional libraries.

Brain*: Data science platform for neurosciences *Research Assistant* — 2009 – 2015
↪ Project page: https://shorturl.at/7pN1i — *VRVis Research Center*

During my time at VRVis, I developed the BrainWarp software for registration of confocal micropscopic images and contributed to the overall codebase of the Brain* software suite.

Funding

Academy of Finland Postdoctoral Fellowship — 2022
Research Council of Finland (Budget: 230.540 €)

Short-term Project — 2022
Helsinki Institute for Information Technology, (Budget: 18.056,73 €)

Scholarship Vienna BioCenter (declined to offer) — 2015

Awards

Top reviewer award Annual Conference on Neural Information Processing Systems (NeurIPS) — 2024
Seal of Excellence European Comission — 2022
AI Networking Fellowship Deutscher Akademischer Austauschdienst (DAAD) — 2020
International Communication Award Austrian Research Association — 2017
Travel Award International Society for Bayesian Analysis — 2017

Skills

Programming Languages	Python, Julia, C++, Matlab, Java, Scala, LaTeX
Tools & Technologies	Machine learning stack (e.g., PyTorch, Wandb, ...), HPC tooling (e.g., SLURM)
Languages	German (native), English (fluent), French (basic)

Supervision Experience

PhD Co-Advisor
↪ **Lassi Meronen** *"Uncertainty Quantification in Deep Learning"* ***(best thesis award)*** — 2023
↪ **Rui Li**, and **Aleksanteri Sladek** — ongoing

Master Thesis
↪ **Aleksanteri Sladek** *"Positive Semi-Definite Probabilistic Circuits"* — 2023
↪ **Philipp Gabler** *"Automatic Graph Tracking in Dynamic Probabilistic Programs"* — 2020

Internships
↪ Anton Baumann (2024), Adam Kania (2023), Marshal Sinaga (2022)
↪ Aleksander Matakos (2022), Hanxiao Chen (2021), Aastha Shah (2021)

Selected Invited Talks & Outreach Activities

Karolinska Institutet Tentative: *"Probabilistic Methods for Reliable Machine Learning"* 2025
Vienna Deep Learning Meetup *"Uncertainty Quantification in Deep Learning"* 2024
Helmholz Munich *"Probabilistic Modeling with Tractable Circuits"* 2024
Tractable Probabilistic Models Workshop *"Bayes Meets Probabilistic Circuits"* 2021
Podcast on Learning Bayesian Statistics *"Bayesian Non-Parametrics & Developing Turing.jl"* 2020

Academic Service

Workshop on Uncertainty Quantification in Computer Vision *Organiser* 2022 – 20225
ECCV 2022, ICCV 2023, ECCV 2024, CVPR 2025

Workshop on Tractable Probabilistic Models *Organiser* 2022 – 2024
UAI 2022 – 2024

ELLIS Seminar on Advancements in Probabilistic Machine Learning *Organiser* 2021 – ongoing
Entropy Special Issue *Guest editor together with Prof. Pierre Alquier* 2021 – ongoing
Area Chair *AISTATS 2025*
Reviewer *NeurIPS, ICML, AISTATS, UAI, CVPR, IJCAI, IEEE TPAMI, Bayesian Analysis*

Selected Publications

Summary: As of January 3, 2025, I published over 10 per-reviewed publications at top-tier machine learning venues (e.g., NeurIPS, ICML, ICLR, ...) with a citation count of 794 and h-index of 13 based on Google scholar.

The following lists a selection of recent publications.

A. Baumann, R. Li, M. Klasson, S. Mentu, S. Karthik, Z. Akata, A. Solin, and M. **Trapp**. Post-hoc Probabilistic Vision-Language Models. *arXiv:2412.06014*, 2024.

R. Li, M. Klasson, A. Solin, and M. **Trapp**. Streamlining Prediction in Bayesian Deep Learning. *arXiv:2411.18425*, 2024.

L. Loconte, A. Sladek, S. Mengel, M. **Trapp**, A. Solin, N. Gillis, and A. Vergari. Subtractive Mixture Models via Squaring: Representation and Learning. In *International Conference on Learning Representations (ICLR)*, 2024.

L. Meronen, M. **Trapp**, and A. Solin. Periodic Activation Functions induce Stationarity. In *34th Advances in Neural Information Processing Systems (NeurIPS)*. Curran Associates, Inc., 2021.

M. **Trapp**, R. Peharz, H. Ge, F. Pernkopf, and Z. Ghahramani. Bayesian Learning of Sum-Product Networks. In *32nd Advances in Neural Information Processing Systems (NeurIPS)*. Curran Associates, Inc., 2019.

M. **Trapp**, R. Peharz, F. Pernkopf, and C. E. Rasmussen. Deep Structured Mixtures of Gaussian Processes. In *23rd International conference on artificial intelligence and statistics (AISTATS)*. PMLR, 2020.

Z. Yu, M. **Trapp**, and K. Kersting. Characteristic Circuits. In *36th Advances in Neural Information Processing Systems (NeurIPS)*. Curran Associates, Inc., 2023.

Active Collaborations

Assoc.Prof. Dr. Trevor Campbell *University of British Columbia, Canada* 2023 – ongoing
Prof. Dr. Alexandre Bouchard-Côté *University of British Columbia, Canada* 2023 – ongoing
Prof. Dr. Kristian Kersting *Technical University of Darmstadt, Germany* 2020 – ongoing
Ass.Prof. Dr. Martin Andraud *UCLouvain, Belgium* 2022 – ongoing
Prof. Dr. Guy Van den Broeck *University of California, Los Angeles (UCLA), USA* 2023 – ongoing

References

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