Marvin Schmitt

Machine Learning Scientist · ELLIS PhD Student

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Education

since 12/2021 **PhD, Computer Science**
University of Stuttgart, Germany
- Working title: Towards Trustworthy Amortized Bayesian Inference with Deep Learning
- Advisors: Prof. Dr. Paul-Christian Bürkner (TU Dortmund), Prof. Dr. Andreas Bulling (University of Stuttgart)
- ELLIS PhD program, co-advised by Prof. Dr. Aki Vehtari (Aalto University, Finland)
- Expected graduation: 08/2024

2020 – 2022 **MSc, Data and Computer Science**
Heidelberg University, Germany
- Grade 1.0 / 4.0 (A+; best: 1.0)
- Master thesis: Visualization of Distribution and Uncertainty of Posterior Model Probabilities

2018 – 2021 **MSc, Psychology**
Heidelberg University, Germany
- Grade 1.0 / 4.0 (A+; best: 1.0)
- Master thesis: Model Misspecification in Bayesian Parameter Estimation Tasks with Invertible Neural Networks

2014 – 2018 **BSc, Psychology**
Heidelberg University, Germany
- Grade 1.2 / 4.0 (A; best: 1.0)
- Bachelor thesis: Influence of Suggestive Questions on Usability Tests

Experience

since 12/2021 **PhD Researcher**
Cluster of Excellence SimTech, University of Stuttgart, Germany
- Authored 9 publications within 24 months, thereof 7 as first author and 3 preprints (detailed list below).
- Delivered 9 research talks and 5 poster presentations at international machine learning venues
- Defined, implemented, and evaluated machine learning algorithms for robust simulation-based inference
- Shaped the lab's research agenda by initiating 3 collaborations with labs in Finland and the U.S.
- Supported budgeting a total of 242 000 EUR Cyber Valley funding across 3 years (travel and student assistant funds)
- Contributed to securing 353 000 EUR of competitive third-party funding for a research software engineering project
- Supervised 4 graduate student assistants and 1 Master's project, managed recruiting process with 20+ applicants

since 12/2021 **Open Source Developer**
BayesFlow package for amortized Bayesian workflows in Python
- Developed an open-source Python package for amortized Bayesian workflows with generative neural networks
- Advanced publicity for the library, as evidenced by a 14x increase in GitHub stars and 3 535 downloads on PyPI
- Designed a testing infrastructure with pytest, automated package documentation with sphinx, and CI/CD pipeline

2017 – 2019 **Network Officer**
Marsilius-Kolleg Center for Advanced Study, Heidelberg University, Germany
- Supported outreach and public relations of state-of-the-art research at Heidelberg University
- Assisted in preparing and conducting interdisciplinary scientific symposia
- Maintained the website and digital knowledge base in Imperia CMS with HTML, CSS, PHP, and JavaScript

2018 **Research Intern**
Quantitative Research Methods in Psychology, Heidelberg University, Germany
- Developed an algorithm to derive expectation measures from eye-tracking data
- Implemented machine learning methods to improve eye-tracking based usability research

Honors & Awards

2024 **Mobility grant (3 000 EUR),** European Lighthouse on Secure and Safe AI (ELSA; EU Horizon)
2023 **Mobility grant (5 000 EUR),** European Network of Excellence Centers (ELISE; EU Horizon)
since 2023 **Associated student,** International Max Planck Research School for Intelligent Systems (IMPRS-IS), Germany
2023 **Academic research grant (1 000 EUR),** Google Cloud Program
2023 **Best paper honorable mention,** German Conference on Pattern Recognition
2019 – 2021 **Scholarship holder,** German Academic Scholarship Foundation (Studienstiftung d. dt. Volkes)
2018 **Teaching certificate for tutors,** Heidelberg University
2014 **Award for remarkable social commitment,** Auguste-Viktoria-Gymnasium, Trier, Germany

Teaching

Taught statistical inference and probability theory to 800+ undergrad, grad, and PhD students across 4 lectures, 4 seminars, 6 exercises, and 7 tutorials (each of which for 90-120 minutes per week over 12 weeks), 4 days of workshops, 140+ exams. Received excellent teaching evaluation with an average score of 1.5, median of 1.0 (lower is better, best: 1.0).

Winter 2023	**Exercise (TA),** Applied Bayesian Data Analysis at TU Dortmund University
Winter 2023	**Workshop (Independent),** Scientific Python for PhD researchers at RTG Statistical Modeling in Psychology
Summer 2022	**Workshop (Independent),** Bayesian statistics with R and brms for PhD researchers at FGME conference, Konstanz
Summer 2022	**Lecture & Exercise (Independent),** Statistical Inference at Fresenius UAS, Heidelberg
Summer 2022	**Exercise (TA),** Bayesian Statistics and Probabilistic Machine Learning at University of Stuttgart
Winter 2021/22	**Lecture & Exercise (Independent),** Statistical Inference at Fresenius UAS, Heidelberg
Winter 2021/22	**Seminar (Independent),** Introduction to Statistics with R for PhD researchers at Heidelberg University
Summer 2021	**Exercise (Independent),** Descriptive Statistics & Probability Theory at Fresenius UAS, Heidelberg
Summer 2021	**Lecture & Exercise (Independent),** Statistical Inference at Fresenius UAS, Heidelberg
Winter 2020/21	**Seminar (TA),** Statistics with R at Heidelberg University
Winter 2020/21	**Lecture & Exercise (Independent),** Statistical Inference at Fresenius UAS, Heidelberg
Summer 2020	**Seminar (TA),** Programming with R at Heidelberg University
2020	**Seminar (Co-Leader),** Communication Techniques at Fresenius UAS, Wiesbaden
2017	**Workshop (Co-Leader),** Group Coaching at Fresenius UAS, Frankfurt
2016–2019	**Exercise (Tutor),** Descriptive Statistics, Probability Theory & Statistical Inference at Heidelberg University

Advised Students

since 12/2023	**Pritom Gogoi,** Research assistant (MSc), University of Stuttgart, Germany
since 12/2023	**Leona Odole,** Research assistant (MSc), TU Dortmund University, Germany
since 09/2023	**Adya Maheshwari,** Research assistant (MSc), TU Dortmund University, Germany
since 05/2023	**Yuga Hikida,** Research assistant (MSc), TU Dortmund University, Germany
08/2022 – 04/2023	**Rebecca Kohlhaas,** Student project (MSc), University of Stuttgart, Germany

Selected Involvement

since 2022	**Reviewer,** ICML (2022), AISTATS (2022, 2023), NeurIPS workshops (AABI2022, DGM4H2023, UniReps2023)
2023	**Member,** Society of SimTech, University of Stuttgart, Germany
2022	**Academic Consultant,** Axem Neurotechnology
2022	**Participant,** 1st SimTech summer school: Knowledge-driven machine learning and its applications
2016 – 2021	**Elected representative,** Examination board M.Sc. & Diploma Psychology (break 10/2016 – 09/2017)
2016 – 2021	**Elected representative,** Institute Council (Fachrat) Psychology
2016 – 2020	**Member,** Student Council (Fachschaft) Psychology

Talks and Presentations

2023	**Research talk (invited),** *Jointly Amortized Bayesian Inference*, Machine and Human Intelligence, University of Helsinki & Finnish Center for Artificial Intelligence (FCAI), Finland
2023	**Presentation,** *Leveraging Self-Consistency for Data-Efficient Amortized Bayesian Inference*, NeurIPS workshop for Unifying Representations in Neural Models (UniReps), New Orleans, US
2023	**Oral,** *Detecting Model Misspecification in Amortized Bayesian Inference with Neural Networks*, German Conference on Pattern Recognition, Heidelberg, Germany, paper awarded with an honorable mention
2023	**Poster,** *Meta-Uncertainty in Bayesian Model Comparison*, SimTech, University of Stuttgart, Germany
2023	**Talk (contributed),** *Amortized Simulation-Based Inference*, ELLIS Doctoral Symposium, Helsinki, Finland
2023	**Journal club moderator,** *Probabilistic Machine Learning*, ELLIS Doctoral Symposium, Helsinki, Finland
2023	**Poster,** *Meta-Uncertainty in Bayesian Model Comparison*, AISTATS 2023, Valencia, Spain
2023	**Talk (invited),** *Detecting Model Misspecification in Amortized Bayesian Inference with Neural Networks*, Bayes Comp conference, Levi, Finland
2023	**Poster,** *Detecting Model Misspecification in Amortized Bayesian Inference with Neural Networks*, Bayes Comp conference, Levi, Finland
2022	**Poster,** *Model Misspecification in Simulation-Based Inference*, ELLIS Unit Stuttgart, Germany
2022	**Talk (invited),** *What is AI?*, Writing workshop for AI short stories, Cyber Valley, Tübingen, Germany
2022	**Poster,** *Model Misspecification in Simulation-Based Inference*, SimTech, University of Stuttgart, Germany
2022	**Talk (invited),** *Where Does AI begin?*, Cyber Valley Office hours (general public audience), Tübingen, Germany
2022	**Talk (invited),** *Validating synthetic training data in probabilistic machine learning*, Blue Yonder Group Inc., Karlsruhe, Germany

Skills

Languages	German (native), English (fluent), French (basic), Latin (basic), Norwegian (basic)
Programming	Python, R, occasionally: C++, Java, JavaScript, HTML, CSS
Data Science	Python (Tensorflow/keras, PyTorch, sklearn, scipy, numpy, pandas, pytest), R (brms, lme4, afex, tidyverse), Stan
Visualization	Python (matplotlib, seaborn), R (ggplot2, plotly, rgl, shiny, gganimate), OpenGL
Documentation	LaTeX (KOMA, tikZ), git, Imperia, Markdown, RMarkdown, Jupyter, sphinx, roxygen, Quarto

Selected Publications

[1] **Schmitt, M.**, Habermann, D., Bürkner, P.-C., Koethe, U., and Radev, S. T. (2023). Leveraging self-consistency for data-efficient amortized Bayesian inference. In *NeurIPS UniReps: the First Workshop on Unifying Representations in Neural Models*

[2] **Schmitt, M.**, Bürkner, P.-C., Köthe, U., and Radev, S. T. (2023). Detecting Model Misspecification in Amortized Bayesian Inference with Neural Networks. *45th German Conference on Pattern Recognition (GCPR)*. Awarded with a best paper honorable mention

[3] Radev*, S. T., **Schmitt*, M.**, Schumacher, L., Elsemüller, L., Pratz, V., Schälte, Y., Köthe, U., and Bürkner, P.-C. (2023). BayesFlow: Amortized Bayesian workflows with neural networks. *Journal of Open Source Software*, 8(89):5702

[4] Radev, S. T., **Schmitt, M.**, Pratz, V., Picchini, U., Köthe, U., and Bürkner, P.-C. (2023). JANA: Jointly Amortized Neural Approximation of Complex Bayesian Models. In Evans, R. J. and Shpitser, I. (eds.), *Proceedings of the 39th Conference on Uncertainty in Artificial Intelligence*, volume 216 of *Proceedings of Machine Learning Research*, pp. 1695–1706. PMLR

[5] **Schmitt, M.**, Radev, S. T., and Bürkner, P.-C. (2023). Meta-Uncertainty in Bayesian Model Comparison. In *Proceedings of The 26th International Conference on Artificial Intelligence and Statistics (AISTATS)*, volume 206 of *PMLR*, pp. 11–29

All Publications

The full publication list is also available via Google Scholar (link).

[1] **Schmitt*, M.**, Pratz*, V., Köthe, U., Bürkner, P.-C., and Radev, S. T., (2023). Consistency models for scalable and fast simulation-based inference. arXiv:2312.05440

[2] **Schmitt, M.**, Radev, S. T., and Bürkner, P.-C., (2023). Fuse it or lose it: Deep fusion for multimodal simulation-based inference. arXiv:2311.10671

[3] Elsemüller, L., Olischläger, H., **Schmitt, M.**, Bürkner, P.-C., Köthe, U., and Radev, S. T., (2023). Sensitivity-aware amortized Bayesian inference. arXiv:2310.11122

[4] **Schmitt, M.**, Habermann, D., Bürkner, P.-C., Koethe, U., and Radev, S. T. (2023). Leveraging self-consistency for data-efficient amortized Bayesian inference. In *NeurIPS UniReps: the First Workshop on Unifying Representations in Neural Models*

[5] **Schmitt, M.**, Bürkner, P.-C., Köthe, U., and Radev, S. T. (2023). Detecting Model Misspecification in Amortized Bayesian Inference with Neural Networks. *45th German Conference on Pattern Recognition (GCPR)*. Awarded with a best paper honorable mention

[6] Radev*, S. T., **Schmitt*, M.**, Schumacher, L., Elsemüller, L., Pratz, V., Schälte, Y., Köthe, U., and Bürkner, P.-C. (2023). BayesFlow: Amortized Bayesian workflows with neural networks. *Journal of Open Source Software*, 8(89):5702

[7] Radev, S. T., **Schmitt, M.**, Pratz, V., Picchini, U., Köthe, U., and Bürkner, P.-C. (2023). JANA: Jointly Amortized Neural Approximation of Complex Bayesian Models. In Evans, R. J. and Shpitser, I. (eds.), *Proceedings of the 39th Conference on Uncertainty in Artificial Intelligence*, volume 216 of *Proceedings of Machine Learning Research*, pp. 1695–1706. PMLR

[8] **Schmitt, M.**, Radev, S. T., and Bürkner, P.-C. (2023). Meta-Uncertainty in Bayesian Model Comparison. In *Proceedings of The 26th International Conference on Artificial Intelligence and Statistics (AISTATS)*, volume 206 of *PMLR*, pp. 11–29

[9] Ewendt*, F., **Schmitt*, M.**, Kluttig, A., Kühn, J., Hirche, F., Kraus, F. B., Ludwig-Kraus, B., Mikolajczyk, R., Wätjen, W., Bürkner, P.-C., Föller§, M., and Stangl§, G. I. (2023). Association between vitamin D status and eryptosis – results from the German National Cohort Study. *Annals of Hematology*