Rui Li

PHD STUDENT · AALTO UNIVERSITY

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Summary

- Ph.D. student at Aalto University, supervised by Prof. Arno Solin. Published on ICLR, ICML, and WACV.
- Specialize in uncertainty quantification, Bayesian methods, and few-shot learning, with experience working on LLMs and VLMs.
- Proficient in Python and Pytorch. Developed SUQ library. Strong mathematical skills in linear algebra, calculus, and probability.

Experience

Aalto University, Ph.D.
2022 - Present
- Advised by Prof. Arno Solin and Dr. Martin Trapp
- Research interests: probabilistic machine learning, uncertainty quantification, few-shot learning
- Final year: published on ICML, ICLR, WACV and four NeurIPS workshops

Nokia Bell Labs, Research Internship
March 2025 - May 2025
- Uncertainty quantification for robotics foundation models

University College London, M.Sc. in Machine Learning
2020 - 2021
- Grade: Distinction (84%), Dean's List
- Thesis: Learning Input-conditional Invariances via the Marginal Likelihood
  Supervised by Prof. Marc Deisenroth, Dr. So Takao, and Prof. Mark van der Wilk

Tokyo University, Research Student
2019 - 2020
- Researched aligning contextual word embedding in a probabilistic manner with variational autoencoder.
- Supervised by Prof. Yoshimasa Tsuruoka

Sun Yat-sen University, B.Sc. in Physics
2015 - 2019
- Grade: 3.8 / 4.0
- Thesis: Deep Learning for Vertex Reconstruction in JUNO Experiment, supervised by Prof. Zhengyun You

Selected Publications

Streamlining Prediction in Bayesian Deep Learning. ICLR 2025

Rui Li, Marcus Klasson, Arno Solin, Martin Trapp.

While estimating posterior has been actively researched in Bayesian deep learning (BDL), how to make predictions with posterior efficiently is largely overlooked. We examine streamlining prediction in BDL through a single forward pass without sampling. We showcase our approach for both MLP and transformers, such as ViT and GPT-2.

Post-hoc Probabilistic Vision-Language Models. Under Review

Anton Baumann, Rui Li, Marcus Klasson, Santeri Mentu, Shyamgopal Karthik, Zeynep Akata, Arno Solin, Martin Trapp.

While Vision-Language models have shown remarkable performance in various tasks, the lack of uncertainty estimation makes them unreliable in high-stakes applications. We propose a post-hoc uncertainty quantification method based on Laplace approximation, which provides useful predictive uncertainties and better calibration.

Flatness Improves Backbone Generalisation in Few-shot Classification. WACV (Oral) 2025

Rui Li, Martin Trapp, Marcus Klasson, Arno Solin.

In few-shot classification most efforts focus on adapting the backbone to the target domain without considering the importance of backbone training. We show flatness-aware backbone training can lead to better generalization through theoretical and empirical results.

Improving Hyperparameter Learning under Approximate Inference in Gaussian Process Models. ICML 2023

Rui Li, ST John, Arno Solin.

Variational inference and expectation propagation are two commonly used approximate inferences in Gaussian process models with complementary advantages. We developed a hybrid training procedure to bring the best of both worlds.

Programming Languages and Tech Skills

- Python, PyTorch, NumPy, TensorFlow, GPFlow, GitHub

- Developed SUQ, a lightweight PyTorch library for uncertainty quantification

I use PyTorch and GitHub on a daily basis for my research. I run experiments on GPU clusters such as LUMI, the fifth fastest supercomputer in the world.

Academic Service

- Organizer of workshop on Uncertainty Quantification for Computer Vision

  Together with colleagues, I co-organized the second and third workshops on Uncertainty Quantification for Computer Vision at ICCV 2023 and ECCV 2024, top venues for computer vision.

- Reviewed for NeurIPS, ICML, ICLR and ECCV workshop.

Awards

- Dean's list at University College London, 2021

  The Dean's List is awarded to the top 5% of graduating students.

- First, third, and second price scholarship at Sun Yat-sen University, 2019, 2018, 2017

  Scholarship is awarded every year based on grades and publications.

- Meritorious Winner of Interdisciplinary Contest in Modeling, 2017

  Organizer: COMAP.

Referees

- Prof. Arno Solin (arno.solin@aalto.fi), Arno is my Ph.D. supervisor.

- Dr. Martin Trapp (martin.trapp@aalto.fi), I work with Martin during my Ph.D. on few-shot learning and Bayesian deep learning.

- Dr. ST John (ti.john@aalto.fi), I work with Ti during my Ph.D. on approximate inference in Gaussian processes.

Full List Publications

- Rui Li, Marcus Klasson, Arno Solin, Martin Trapp. Streamlining Prediction in Bayesian Deep Learning. *International Conference on Learning Representations (ICLR)*, 2025.

- Anton Baumann, Rui Li, Marcus Klasson, Santeri Mentu, Shyamgopal Karthik, Zeynep Akata, Arno Solin, Martin Trapp. Post-hoc Probabilistic Vision-Language Models.. *Under Review*

- Rui Li, Martin Trapp, Marcus Klasson, Arno Solin. Flatness Improves Backbone Generalisation in Few-shot Classification. *Winter Conference on Applications of Computer Vision (WACV)*, Oral Presentation, 2025.

- Rui Li, Marcus Klasson, Arno Solin, Martin Trapp. Posterior Inferred, Now What? Streamlining Prediction in Bayesian Deep Learning. *NeurIPS Workshop on Bayesian Decision-making and Uncertainty* 2024.

- Anton Baumann, Marcus Klasson, Rui Li, Arno Solin, Martin Trapp. Probabilistic Active Few-Shot Learning in Vision-Language Models. *NeurIPS Workshop on Bayesian Decision-making and Uncertainty* 2024.

- Marlon Tobaben, Marcus Klasson, Rui Li, Arno Solin, Antti Honkela. Differentially Private Continual Learning using Pre-Trained Models. *NeurIPS workshop on Scalable Continual Learning for Lifelong Foundation Models* 2024.

- Rui Li, ST John, Arno Solin. Improving Hyperparameter Learning under Approximate Inference in Gaussian Process Models. *International Conference on Machine Learning (ICML)*, 2023.

- Rui Li, ST John, Arno Solin. Towards Improved Learning in Gaussian Processes: The Best of Two Worlds. *NeurIPS Workshop on Gaussian Processes, Spatiotemporal Modeling, and Decision-making Systems,* 2022.

- Arno Solin, Rui Li, Andrea Pilzer. A Look at Improving Robustness in Visual-inertial SLAM by Moment Matching. *International Conference on Information Fusion (FUSION)*, 2022.

- Chuan Chen, Rui Li, Lin Shu, Zhiyu He, Jining Wang, Chengming Zhang, Huanfei Ma, Kazuyuki Aihara, Luonan Chen. Predicting Future Dynamics From Short-term Time Series Using an Anticipated Learning Machine. *National Science Review,* 2020.

- Rui Li, Fanghua Ye, Shaoan Xie, Chuan Chen and Zibin Zheng. Digging into It: Community Detection via Hidden Attributes Analysis. *Neurocomputing,* 2019.

- Rui Li, Zhengyun You and Yumei Zhang. Deep Learning for Signal and Background Discrimination in Liquid based Neutrino Experiment. *International Workshop on Advanced Computing and Analysis Techniques in Physics Research (ACAT),* 2018.