

Prakhar Verma

MACHINE LEARNING RESEARCHER · PHD STUDENT

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Summary

Final-year PhD student in Machine Learning at [Aalto University, Finland](#), advised by [Prof. Arno Solin](#), with publications at NeurIPS, AISTATS, and ICML. My research spans both academic and industrial research through roles at [Adobe Research](#), [Microsoft Research](#), [University of Oxford](#), and [TomTom](#). Through my research I aim to explore techniques for efficient reasoning and planning in large language models (LLMs), principled downstream applications of LLMs using Bayesian principles, probabilistic machine learning, and efficient inference techniques.

Skills

- **Areas of Expertise:** Probabilistic Machine Learning, Generative Modeling, Retrieval-Augmented Generation (RAG), Large Language Models (LLMs), Deep Learning, Gaussian Processes, Bayesian Learning, Uncertainty Quantification
- **Frameworks & Libraries:** PyTorch, JAX, Hugging Face Transformers, TensorFlow, GPflow, NumPy, scikit-learn
- **Languages & Tools:** Python, Java, C, Git, AWS, Docker
- **MLOps:** Weights & Biases, Hydra

Experience

Adobe Research

Bangalore, India

RESEARCH INTERN

June 2024 - August 2024

- **Project:** Developed a novel **Bayesian causal discovery** framework in sequential data using **language models (LMs)**. The approach grounds *global*-LM knowledge into *local*-observational data, tackling **dual bias** (LM-bias and data-bias) enabling iterative causal structure refinement.
- **Outcome:** Resulted in a patent-pending method, and a research publication which can be found at [link](#).

Microsoft Research

Bangalore, India

RESEARCH INTERN

March 2024 - May 2024

- **Project:** Researched and developed **Plan*RAG**, a reasoning and planning framework for **Retrieval-Augmented Generation (RAG)**, optimizing multi-hop query performance by reducing latency and computational cost at test time; providing **traceable reasoning DAG**.
- **Outcome:** Resulted in a research publication at ICLR 2025 workshop available at [link](#).

University of Oxford

Oxford, United Kingdom

VISITING RESEARCHER

July 2023 - September 2023

- **Project:** Collaborated with [Prof. Seth Flaxman](#) and [Elizaveta Semenova](#), focusing on **encoding prior** information and developing **efficient inference techniques** especially tailored for life sciences and medical applications.
- **Outcome:** Resulted in a research publication available at [link](#).

Aalto University

Espoo, Finland

RESEARCH ASSISTANT

April 2020 - August 2022

- **Project:** Member of the [AaltoML group](#); focused on **probabilistic machine learning** to develop learning and **efficient approximate inference** methods for dynamical systems and stochastic differential equation (SDE) models.
- **Outcome:** Resulted in a research publication at NeurIPS 2021 available at [link](#) and contribution to an open-source project [MarkovFlow](#).

SpectacularAI

Espoo, Finland

RESEARCH ENGINEER (PART-TIME)

September 2021 - September 2022

- Consulted for an electronics firm, researching methods to incorporate **uncertainty estimation** in deep learning models like MCDropout and Laplace approximation to improve robustness.

TomTom

Pune, India

SOFTWARE ENGINEER (R&D)

July 2016 - August 2019

- Researched and developed a **semantic segmentation** solution for extracting map features from satellite imagery and automatically ingesting them into the database, removing human-in-the-loop.
- Developed a proof-of-concept (PoC) for a real-time map vector tile server, which was later converted into an open platform product.
- Developed an ArcGIS plugin used daily by surveyors across the globe for field surveying and reporting.

Education

Aalto University

Finland

DOCTOR OF PHILOSOPHY (PH.D.)

2022 - Present

- Exploring statistical machine learning with [Prof. Arno Solin](#).
- Broadly researching Generative AI, Large Language Model (LLM) and Retrieval-Augmented Generation (RAG), Probabilistic Modeling, and Efficient Inference Techniques.

Aalto University

Finland

MASTER OF SCIENCE (M.Sc.) - 4.7/5 (PASS WITH HONORS)

2019 - 2021

- Major in Machine Learning, Data Science, and Artificial Intelligence and Minor in Mathematics
- Thesis: [Sparse Gaussian processes for stochastic differential equations](#) with AaltoML.

Uttarakhand Technical University

India

BACHELOR OF TECHNOLOGY (B.TECH.) - 79.03% (FIRST DIVISION WITH HONORS)

2012 - 2016

- Specialization in Information Technology
- Thesis: [Development of automated GIS Tools on various platforms](#) with TomTom, India.

Publications

- **Prakhar Verma**, David Arbour, Sunav Choudhary, Harshita Chopra, Arno Solin, Atanu R. Sinha. Think Global, Act Local: Bayesian Causal Discovery with Language Models in Sequential Data. (*Under review*)
- **Prakhar Verma**, Sukruta Prakash Midigeshi, Gaurav Sinha, Arno Solin, Nagarajan Natarajan, Amit Sharma. Plan*RAG: Efficient Test-Time Planning for Retrieval Augmented Generation. Workshop on *Reasoning and Planning for Large Language Models* at ICLR 2025.
- **Prakhar Verma**, Vincent Adam, Arno Solin. Variational Gaussian Process Diffusion Processes. *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2024.
- Paul Edmund Chang*, **Prakhar Verma***, S.T. John, Arno Solin, Mohammad Emtiyaz Khan. Memory-based dual Gaussian processes for sequential learning. *International Conference on Machine Learning (ICML)*, 2023. (*Oral Presentation*)
- Arno Solin, Ella Tamir, **Prakhar Verma**. Scalable Inference in SDEs by Direct Matching of the Fokker–Planck–Kolmogorov Equation. *Advances in Neural Information Processing Systems 35 (NeurIPS)*, 2021.
- **Prakhar Verma**, Paul Chang, Arno Solin, Mohammad Emtiyaz Khan. Sequential Learning in GPs with Memory and Bayesian Leverage Score. *Asian Conference in Machine Learning (ACML) workshop “Continual Lifelong Learning” 2022 (Contributed talk)*.
- Paul Chang, **Prakhar Verma**, ST John, Victor Picheny, Henry Moss, Arno Solin. Fantasizing with Dual GPs in Bayesian Optimization and Active Learning. *Gaussian Processes, Spatiotemporal Modeling, and Decision-making Systems, NeurIPS Workshop*, 2022.
- Elizaveta Semenova, **Prakhar Verma**, Max Cairney-Leeming, Arno Solin, Samir Bhatt, Seth Flaxman. PriorCVAE: Scalable MCMC parameter inference with Bayesian deep generative modelling. (*Under review*)
- **Prakhar Verma**, Vincent Adam, Arno Solin. Sparse Gaussian Processes for Stochastic Differential Equations. *The Symbiosis of Deep Learning and Differential Equations (DLDE), NeurIPS Workshop*, 2021.
- Fuzail Palnak*, Kshitij Nikhal*, **Prakhar Verma***, Ravi Panchani*, and Sagar Rohankar*. M.A.G.E.C: machine assisted geometry extraction and creation. *Twelfth International Conference on Machine Vision (ICMV 2019)*.

Accomplishments

- Awarded “[Nokia Scholarship](#)” in 2024 for exceptional progress and research excellence during doctoral studies.
- Awarded “[Dean Scholarship](#)” in 2020 and 2021 at Aalto University for commendable academic progress during MSc studies.
- Awarded “[Face of TomTom 2018](#)” for actively representing TomTom in conferences and promoting the brand.
- Winner of TomTom “[Innovation Day 2018](#)”, presented an AI plugin which bridges the gap between machines and cartographers.
- Mentor at “[TomTom External Hackathon 2018](#)”.
- Tensorflow case study on how convolution neural networks can be used to extract road networks and airports from satellite imagery and how TFServing can host the models at [Google Developers Group 2018](#).
- An end-to-end machine learning framework to detect and extract essential map features from satellite imagery and ingest them into the database removing human-in-the-loop at [GeoSpatial World Forum 2018](#).
- Oracle Certified Associate Java SE 7 programmer.