Roman Knyazhitskiy
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Summary

Machine Learning Engineer with expertise in PyTorch/JAX and deep learning fundamentals, specializing in model optimization and scaling. Experience developing efficient ML systems for robotics and reinforcement learning, with strong Python/C++ skills and contributions to open-source ML libraries. Research background in AutoML, Meta Learning, and LLM applications with publications in top-tier venues.

Education

MPhil in MLMI (Machine Learning), University of Cambridge — 10/2025 - 09/2026

BSc Computer Science and Engineering, TU Delft — 09/2022 - 07/2025

- GPA: 8.7/10. Cum Laude + Honours.

Work Experience

Research Associate, TU Delft — 03/2023 - 08/2025

- Researched LLM applications including vulnerability detection and code generation
- Investigated Prior-Data Fitted Networks (PFNs) and MCMC acceleration methods
- Delivered talks on optimization methods including Adam's L_∞ norm properties
- Participated in academic discussions on diffusion models and Meta Learning

Machine Learning Engineer, Delft Mercurians — 05/2023 - 09/2025

- Designed and implemented Model Predictive Control system for real-time trajectory optimization
- Built JAX+Equinox differentiable simulator tailored for robotic systems
- Integrated Python-based models into Rust codebase with communication protocols
- Contributed to open-source JAX-based ML libraries during development

Publications

[1] J. Luijmes, A. Gielisse, R. Knyazhitskiy, and J. van Gemert. ARC: Anchored representation clouds for high-resolution INR classification. In *ICLR 2025 Workshop on Weight Space Learning*, 2025. Accepted.

[2] R. Knyazhitskiy and P. R. Van der Vaart. A simple scaling model for bootstrapped DQN. 2025. Under review.

Selected Projects

Bootstrapped DQN Scaling Laws, JAX, Deep RL Research — 2025

- Conducted large-scale empirical study (¿40,000 configurations) of ensemble-based exploration methods
- Implemented Bootstrapped DQN and Randomized-Prior BDQN in JAX with multi-GPU support
- Discovered scaling laws governing convergence, showing RP-BDQN solves $1.5\times$ harder tasks

- Optimized training with XLA compilation, bfloat16 precision, and automatic multi-GPU sharding

Nano JAX GPT, JAX, Equinox, Deep Learning 2023

- Implemented high-performance GPT transformer with custom Flash Attention in JAX
- Supported distributed training across multiple accelerators using PositionalSharding
- Explored optimization techniques including RoPE embeddings, RMSNorm, and early-exit decoding
- Built training infrastructure with AdamW optimizer, gradient clipping, and checkpoint management

IEFT-PFN: Inference Efficient Freeze-Thaw Prior Fitted Networks, JAX, Equinox, Deep Learning 2025

- Developed transformer-based system for hyperparameter optimization using in-context learning
- Implemented three hyperparameter weighting schemes for multi-curve aggregation
- Achieved 15-20% improvement over baseline through learned attention weighting
- Optimized training with gradient accumulation and mixed precision handling

Weather forecasting and option trading system, Python, JAX/Equinox, Machine Learning 2025

- Developed end-to-end algorithmic trading system integrating probabilistic ML models
- Implemented Continuous Normalizing Flow model using neural ODEs for uncertainty-calibrated predictions
- Designed frontier-based decision framework using epistemic uncertainty bounds
- Leveraged JAX's XLA compilation and hardware acceleration for efficient training

Open Source Contributions

- Enhanced functionalities in jaxtyping and Equinox
- Contributed to Gymnax, a JAX RL environments collection
- Improved libccd (collision detection library) fixing critical corner-case infinite loop

Honours and Awards

- **1st Place**, Bunq Hackathon 6 (2025) – Team of 4 against 50+ teams, €30,000 prize
- **2nd Place & Special Prize**, Epoch AI Hackathon (2024)
- **Silver Medal**, AIIJC International AI Competition for Juniors