

Farshid Varno

Intro

Seasoned AI/Hardware Co-Design Engineer with 15+ years of experience in hardware-aware software development, hardware design, and AI research. I leverage expertise in systems programming, computer architecture, and system simulation to design and optimize solutions for large-scale machine learning infrastructure. My track record includes patented AI accelerator architectures, impactful research in distributed machine learning, development of FPGA-based telecom and encryption modules, and optimizing hardware-software integration for AI systems. Driven by a passion for bridging AI, software, and hardware, I am actively deepening my expertise in low-level systems programming and compiler technologies by learning Rust, MLIR, and LLVM, to contribute to high-performance ML infrastructure.

Experience

Research & Industry

Research Scientist (AI/HW co-design), [Rain](#)

August 2023–present, San Francisco, USA

- Driving the architecture of LUT-based non-linear functions.
- Leading the design of a scalable C++ numerics library to support arithmetic operations and quantization for OCP Microscaling formats.
- Conducting AI/HW co-optimization with mixed-precision quantization & RISC-V custom instructions.
- Integrated custom operations into PyTorch's FX/TorchDynamo tracing pipeline.
- Designing high-performance Compute-in-Memory (CIM) hardware units with SystemC and QEMU, alongside developing high-level scalable simulation systems and AI performance models for quantization and attention mechanisms.
- Led the design of a sparse VMM unit and an online FP Softmax unit with Base-2 conversion.
- Led on-device training and domain adaptation efforts.
- Inventor on four patents for Softmax HW and core CIM architecture, three of which as the lead inventor.

Research Scientist, [Imagia](#)

May 2018–March 2022 (internship period included), Montreal, Canada

- Led research on Federated Learning optimization, achieving SoTA performance via drift elimination.
- Researched Transfer Learning, out-of-distribution generalization, Meta-Learning, and Few-Shot Learning.
- Contributed to the design of an AI library to enhance Imagia's research efforts.
- Published a patent on Transfer Learning as the lead inventor.
- Scaled and optimized AI training workloads by porting and configuring the Polyaxon MLOps platform on distributed DGX GPU clusters, enhancing resource efficiency and researcher productivity.

Research Assistant, [Institute for Big Data Analytics](#)

May 2017–May 2018, Halifax, Canada

- Engineered and optimized a custom CUDA kernel for high-throughput streaming data processing, demonstrating expertise in accelerator programming and low-level performance tuning led to ~1000x speedup compared to the original CPU-based approach.
- Developed a CNN framework for detecting aircraft corrosion with D-Sight technology (DAIS).
- Researched sparsity, activation functions, and normalization for efficient machine learning models.

- Collaborated with Harvard University to research human behavior prediction from fMRI data.

Data Scientist (part-time), [Cognitive Health and Recovery Research Lab](#)

Mar 2020–Jun 2020, Halifax, Canada

- Integrated and visualized clinical data to support cognitive health research.
- Investigated post-operative cognitive dysfunction in elderly patients through data analysis.
- Analyzed surgical time series data (e.g., anesthesia depth, patient vitals) to identify patterns and insights.

FPGA Engineer, [Kara Telephone Co.](#)

Jun 2013–Jun 2014, Tehran, Iran

- Designed, implemented, and integrated TDM switches on FPGAs, supporting up to 16k x 16k channels.
- Developed a multi-channel I2C master controller for 16 modules with error checking and correction.
- Designed and implemented SPI and USART peripheral interfaces, ensuring seamless system integration.
- Worked with embedded processors and RTOS, optimizing hardware-software interaction.
- Led speed optimization efforts for FPGA designs on Altera Cyclone series.

RTL Designer Intern, [SarvNet Telecommunication Inc.](#)

March 2012–Sep 2012, Isfahan, Iran

- Designed and implemented AES modules for encryption in STM4 lines, ensuring efficient performance.
- Developed resource-sharing mechanisms to support both 128-key and 256-key AES modes, adapting dynamically based on the selected encryption mode.
- Area optimization for FPGA designs, targeting Xilinx Virtex 4 and 6 series to minimize resource usage.

Teaching

- Adjunct Professor, Computer Architecture, Chehelsotoon Institute for Higher Education, Fall 2015
- Adjunct Professor, System Programming, Chehelsotoon Institute for Higher Education, Fall 2015
- Co-instructor, Machine Learning for Big Data (CSCI-6515), Dalhousie University, Fall 2020
- Teaching Assistant, Machine Learning for Big Data (CSCI-6515), Dalhousie University, Fall 2018
- Teaching Assistant, Digital Circuits (ECED-2200), Dalhousie University, Winter 2016
- Teaching Assistant, System Analysis (ECED-3401), Dalhousie University, Fall 2016
- Teaching Assistant, Java Programming, University of Guilan, Winter 2009
- Teaching Assistant, Algorithms, University of Guilan, Winter 2010

Background

Education

- Ph.D., Computer Science. Dalhousie University. 2016–2023, CGPA: 4.19
- M.Sc., Computer Architecture. University of Isfahan. 2012–2015, CGPA: 4.02
- B.Sc., Computer Engineering, Guilan University. 2008–2012.

Skills

Programming Languages: Python, C++, CUDA

Systems Programming & Compiler Technologies:

- **Proficient In:** RISC-V Extensions, PyTorch Dynamo Integration, Low-Level Performance Optimization

- **Actively Learning:** Rust, MLIR, LLVM, Triton

AI & Machine Learning: Distributed Machine Learning (Federated Learning), Transfer Learning, Quantization & Compression, On-Device Training, LLM & Attention Architecture Performance Modeling

ML Infrastructure & HPC: System Simulation (SystemC, QEMU), AI Performance Modeling

Hardware Design & Verification: VHDL, Verilog, SystemC

Developer & MLOps Tools: Git, GitHub Actions, Bazel, Polyaxon, MLflow

Selected Publications

Papers

- Varno, Farshid, Marzie Saghayei, Laya Rafiee, Sharut Gupta, Stan Matwin, and Mohammad Havaei. “Minimizing Client Drift in Federated Learning via Adaptive Bias Estimation.” *European Conference on Computer Vision*. – **ECCV** (2022).
- Varno, Farshid, Lucas May Petry, Lisa Di Jorio, and Stan Matwin. “Learn Faster and Forget Slower via Fast and Stable Task Adaptation.” *arXiv preprint arXiv:2007.01388* (2020).
- Varno, Farshid, Behrouz Haji Soleimani, Marzie Saghayei, Lisa Di Jorio, and Stan Matwin. “Efficient neural task adaptation by maximum entropy initialization.” *arXiv preprint arXiv:1905.10698* (2019).
- Jiang, Xiang, Mohammad Havaei, Farshid Varno, Gabriel Chartrand, Nicolas Chapados, and Stan Matwin. “Learning to learn with conditional class dependencies.” In *international conference on learning representations*. – **ICLR** (2018).
- Saghayei, Marzie, Jonathan Greenberg, Christopher O’Grady, Farshid Varno, Muhammad Ali Hashmi, Bethany Bracken, Stan Matwin, Sara W. Lazar, and Javeria Ali Hashmi. “Brain network topology predicts participant adherence to mental training programs.” *Network Neuroscience* 4, no. 3 (2020): 528-555.

Patent

- Varno, Farsheed, Behrouz Haji Soleimani, Marzie Saghayei, Lisa Di Jorio, and Stan Matwin. Method and system for initializing a neural network. <https://patents.google.com/patent/WO2020225772A1> (2020).
- Four provisional patent applications filed on the following topics:
 - Softmax Hardware with Base-2 transformation (lead inventor).
 - Block quantization and online Softmax resource sharing (lead inventor).
 - Efficient sequential VMM unit with bit-level sparsity (lead inventor).
 - A new compute-tile topology with close-to-logic HBM stack (co-inventor).

Recognition

- **Vice-president of Public Relations**, Toastmasters International, Dal Toastmasters, 2020.
- **Mitacs Accelerate Award**, 56k CAD, 2021–2022.
- **Scotia Scholar Award**, 45k CAD, Research Nova Scotia, 2019–2021.
- **Best Graduate Student Research Award**, Big Data Congress, Sep 2017.
- Selected **Conference Program Committee Member** for ICLR (2020), KDD (2017), and Confoo (2023).
- **Reviewer** for top AI conferences: CVPR 2023/24/25, ECCV 2022/24, ICCV 2023, FedVision 2023.
- **1st Rank Student Recognition**, University of Isfahan, Mar 2015.
- Mentored post-secondary students through various programs and occasions (e.g., AI4ALL 2024).