Pouria Mahdavinia

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Education

PhD: Computer Science at Penn State University 2021–2026

MSc: Computer Science at Penn State University 2021-2024

BSc: Electrical Engineering at Sharif University of Technology 2015-2020

Employment

Graduate Research Assistant at Penn State 2021-Present

- Researching post-training efficiency and accessibility of Small Language Models (SLMs): model merging and memory-efficient/asynchronous-distributed training

Research Engineering Intern at Qualcomm Summer 2024

- Worked on CABAC algorithms for ECM Video Compression. Contribution adopted to ECM codebase (JVET-AI0281)

Research Engineering Intern at Qualcomm Summer 2023

- Developed film-grain analysis/synthesis algorithms for Video Compression technology including VVC and AV1

Selected publications

"Harnessing Optimization Dynamics for Curvature-Informed Model Merging" *[Paper] [Code] [Under review]*

Pouria Mahdavinia, Hamed Mahdavi, Niloofar Mireshghallah, Mehrdad Mahdavi

- Benchmarked **capability-based model merging for post-training** at 8B scale
- Empirically demonstrated that simple linear merging exhibits implicit Fisher optimality
- Proposed a novel task-vector pruning method called Fast-Fisher-Grafting (FFG), and integrated all findings in a new model merging algorithm: the **OTA** framework

"Low-rank Momentum Factorization for Memory Efficient Training" *[Paper] [Code]*

Pouria Mahdavinia, Mehrdad Mahdavi **|** (Awarded J2C Certification)

Transactions on Machine Learning Research (TMLR 2025)

- Developed **MoFaSGD**, a **memory-efficient Muon** optimizer variant, achieving consistent and high throughput gains compared to other memory-efficient optimizers while maintaining LoRA-like GPU memory usage compared to Muon. Validated on NanoGPT and AllenAI Tulu3-SFT at 8B scale

"Refgrader: Automated Grading Of Mathematical Competition Proofs Using Agentic Workflows" *[Paper] [Code]*

Hamed Mahdavi, **Pouria Mahdavinia**, Samira Malek, Pegah Mohammadipour, Alireza Hashemi, Majid Daliri, Alireza Farhadi, Amir Khasahmadi, Niloofar Mireshghallah, Vasant Honavar

MATH-AI NeurIPS 2025

- Worked on a benchmark evaluating frontier LLMs on multi-level IMO proof grading and helped design agentic systems that outperformed single-turn approaches

"CombiGraph-Vis: A Curated Multimodal Olympiad Benchmark for Discrete Mathematical Reasoning" *[Paper]* *[Code]*
Hamed Mahdavi, **Pouria Mahdavinia**, Alireza Farhadi, Pegah Mohammadipour, Samira Malek, Pedram Mohammadipour, Majid Daliri, Alireza Hashemi, Amir Khasahmadi, Vasant G Honavar
MATH-AI NeurIPS 2025

- Worked on evaluating frontier open- and closed-source LLMs on multimodal problems at the Informatics Olympiad level by sourcing and curating Iranian Informatics Olympiad problems and solutions

"Distributed personalized empirical risk minimization" *[Paper]*
Yuyang Deng, Mohammad Mahdi Kamani, **Pouria Mahdavinia**, Mehrdad Mahdavi
NeurIPS 2023

"Tight Analysis of Extra-gradient and Optimistic Gradient Methods For Nonconvex Minimax Problems" *[Paper]*
Pouria Mahdavinia, Yuyang Deng, Haochuan Li, Mehrdad Mahdavi
NeurIPS 2022

Technical Skills

Programming: Python, C/C++, CUDA

ML Tools: PyTorch, JAX, vLLM, DeepSpeed ZeRO, PyTorch FSDP, Verl, Prime-RL training stack, mergekit, Llama-Factory Post-training stack, Verifiers (RL environments), Reasoning Gym, lm-evaluation-harness, OLMES

Research Areas: Small Language Model (SLM) pre-/post-training, Model Merging, LLM Reasoning & Evaluation, Reinforcement Learning, Asynchronous Distributed Training (DiLoCo-style), Training Infrastructure Optimization, Deep Learning Optimization Algorithms, Quantization, Pruning

Development Tools: Git, Docker, Claude Code, Cursor, Cloud GPU Deployment (Modal, Prime-Intellect), WandB

Honors & awards

Awarded $10,000 compute grant from Modal 2025

- Used compute grant to build **OTA** and currently extending it to GRPO-based training on small models

Second-place winner of Qualcomm's global intern hackathon Summer 2024

- Led a team of 4 talented undergraduate students to build a RAG-based AI onboarding assistant with on-device inference using Snapdragon® X Elite

Silver Medal, Iranian National Mathematical Olympiad 2014

- Selected as one of 40 from 100,000+ candidates for National Olympiad Summer Program; awarded Silver Medal.