Ehsan Lari

Machine Learning Scientist

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Profile

Accomplished machine learning researcher from NTNU, specializing in data science and hands-on Python (PyTorch, NumPy, Pandas, Scikit-Learn, Matplotlib). Delivered algorithms improving performance by 15% and efficiency by 80%, with hands-on expertise in Microsoft Azure, Databricks, Kubernetes, Docker, ETL/ELT pipelines, and Microsoft Fabric. Proficient in MATLAB, SQL, and statistics, with practical ML solutions. Drives cross-functional innovation to deliver high-impact, user-centric data solutions.

Professional Experience

Research and Teaching Assistant **January 2020 – July 2025**
Norwegian University of Science and Technology (NTNU) *Trondheim, Norway*

- Developed robust algorithms using Python and MATLAB for federated learning, distributed NMF, and maximum consensus, enhancing resilience to noise and privacy in large-scale signal processing and machine learning systems.
- Authored 7 peer-reviewed publications in top-tier venues (IEEE TSIPN, Elsevier SP, ICASSP, SSP, APSIPA, EUSIPCO) on distributed optimization and privacy-preserving data systems, advancing efficient and secure technology solutions.
- Mentored students in research projects, leveraging Python, MATLAB, and Docker to bridge data science and engineering through distributed system integration and algorithm development.

Assistant Professor **August 2022 – December 2022**
Norwegian University of Science and Technology (NTNU) *Trondheim, Norway*

- Delivered lectures on advanced signal processing using Python and Verilog, supporting over 200 master's students in understanding engineering technology frameworks and statistical models.
- Supervised graduate projects involving machine learning and electronic systems integration.

Achievements

Norwegian University of Science and Technology (NTNU) **January 2020 – March 2024**
Doctor of Philosophy (PhD) — Signal Processing and Machine Learning *Trondheim, Norway*

Certificates

- MATLAB
- Python
- SQL
- Docker
- Microsoft Azure
- Microsoft Fabric
- Kubernetes
- Databricks

Education

Norwegian University of Science and Technology (NTNU) **January 2020 – March 2024**
Doctor of Philosophy (PhD) — Signal Processing and Machine Learning *Trondheim, Norway*

Technical Skills

Programming Languages: Python (Scikit-Learn, PyTorch, NumPy, Pandas), MATLAB, SQL
Software & Tools: MATLAB, cloud platforms (AWS, Azure), engineering systems integration (BIM concepts, Asset Information Management, Digital Twin), Git, Microsoft Office
Technologies: Machine Learning, Generative AI, Machine Vision, Forecasting, Data Analytics, IoT, Software Development, Ethical and Explainable AI, Engineering Data Management

Soft Skills: Problem-Solving, Communication, Cross-Functional Collaboration, Teamwork, Adaptability, Stakeholder Management, Pragmatic Programming

Projects and Publications

Resilience in Online Machine Learning **April 2022 – August 2024**

- Developed the PSO-Fed algorithm for online federated learning, enabling privacy-preserving model training on distributed streaming data with reduced communication overhead.
- Proved PSO-Fed's convergence under Byzantine model-poisoning attacks through theoretical analysis, deriving a mean square error formula incorporating stepsize and attack parameters.
- Optimized PSO-Fed's robustness by identifying a non-trivial stepsize, outperforming state-of-the-art federated learning algorithms in resilience to malicious client attacks.
- Published findings in IEEE TSIPN (Q1 journal) and presented at IEEE ICASSP, a leading signal processing conference, demonstrating PSO-Fed's superior performance via extensive simulations.

Noise-Robust and Resource-Efficient Machine Learning **April 2023 – February 2025**

- Developed a novel federated learning algorithm to enhance robustness to communication noise while minimizing client-server communication load.
- Formulated the algorithm using weighted least-squares regression, solved via ADMM with random client scheduling for efficient distributed optimization.
- Enhanced performance by eliminating dual variables and enabling continuous local model updates, improving resilience to noisy links.
- Proved mean and mean-square convergence theoretically, with simulations confirming superior performance over existing FL methods.
- Published in Elsevier Signal Processing (Q1 journal) and presented at IEEE SSP and IEEE APSIPA, showcasing significant robustness and efficiency gains.

Privacy-Preserving Nonnegative Matrix Factorization **January 2024 – September 2024**

- Developed a privacy-preserving algorithm for fully-distributed nonnegative matrix factorization (NMF) to decompose large data matrices over ad-hoc networks.
- Enabled collaborative estimation of matrix factors while safeguarding local data privacy using the Paillier cryptosystem for secure, encrypted computations.
- Implemented a decentralized approach to prevent raw data sharing among agents, ensuring robust privacy in distributed signal processing applications.
- Validated algorithm effectiveness through simulations on synthetic and real-world datasets, demonstrating accurate factor estimation with preserved privacy.
- Presented findings at EUSIPCO, a leading signal processing conference, showcasing the algorithm's applicability to privacy-sensitive machine learning tasks.

Distributed Maximum Consensus **February 2024 – September 2024**

- Developed the RD-MC algorithm for distributed maximum consensus, enabling robust estimation of maximum values in multi-agent networks over noisy communication links.
- Reformulated the maximum consensus problem as a distributed optimization task, solved efficiently using the alternating direction method of multipliers (ADMM).
- Enhanced robustness and efficiency by utilizing a single set of noise-corrupted estimates and applying moving averaging to local estimates.
- Demonstrated RD-MC's superior resilience to communication link noise through extensive simulations, outperforming existing maximum-consensus algorithms.
- Presented results at EUSIPCO, a leading signal processing conference, showcasing the algorithm's effectiveness in noisy distributed environments.