ABOLFAZL HASHEMI

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CURRENT POSITION

Assistant Professor
Purdue University — August 2021 – present
Elmore Family School of Electrical and Computer Engineering

- Director of Machine Intelligence and Networked Data Science Group (MINDS)
- Primary member of Communications, Networking, Signal and Image Processing (CNSIP)
- Member of Computer Engineering (Artificial Intelligence)

RESEARCH DESCRIPTION

The goal of my research is to advance the field of Large-Scale Optimization. My group provides actionable insights from the perspective of this foundational field to innovate multiple domains including Machine Learning, Deep Learning, Online Learning, Learning in Games, and Networked/Distributed Decision-Making. In doing so, our group designs efficient algorithms with mathematical guarantees to render practical deployment of learning-based systems possible under a variety of considerations such as limited resources, robustness, and adversarial behaviors. Recent applications include Federated Learning, Medical Image Analysis, NextG Manufacturing, and Cyber-Physical Systems.

EDUCATION

Doctor of Philosophy (Ph.D.), Electrical and Computer Engineering — 2016 – 2020
University of Texas at Austin, Austin, Texas, USA

Master of Science in Engineering (M.S.E.), Electrical and Computer Engineering — 2014 – 2016
University of Texas at Austin, Austin, Texas, USA

Bachelor of Science (B.S.), Electrical Engineering — 2010 – 2014
Sharif University of Technology, Tehran, Iran

PREVIOUS POSITIONS

Postdoctoral Fellow
University of Texas at Austin — 2020 – 2021
Oden Institute for Computational Engineering and Sciences
Advisors: Prof. Rachel Ward, Prof. Inderjit Dhillon, Prof. Ufuk Topcu

Graduate Research and Teaching Assistant
University of Texas at Austin — 2014 – 2020
Department of Electrical and Computer Engineering
Advisor: Prof. Haris Vikalo

Data Scientist Intern
Cognitive Scale, Austin, Texas — Summer 2017

Undergraduate Research Intern
Hong Kong University of Science and Technology — Summer 2013
Department of Electrical and Computer Engineering
Host: Prof. Daniel Palomar

Undergraduate Research and Teaching Assistant
Sharif University of Technology 2012 – 2014
Department of Electrical Engineering

INVITED PRESENTATIONS

1. No-Regret Learning in Dynamic Stackelberg Games, *Multi-Agent Dynamic Games workshop at International Conference on Intelligent Robots and Systems (IROS)*, Oct. 2023.
2. Theory-guided Methods for Private Federated Learning, *SIAM Conference on Computational Science and Engineering*, March 2023.
3. No-Regret Learning in Dynamic Stackelberg Games, *Information Theory and Applications Workshop*, Feb. 2023.
4. Generalization Bounds for Sparse Random Feature Expansions, *SIAM Conference on Mathematics and Data Science (MDS)*, September 2022.
5. Faster Non-Convex Federated Learning via Global and Local Momentum, *2022 NSF TRIPODS PI Meeting*, September 2022.
6. On the Convergence of Differentially Private Federated Learning on Non-Lipschitz Objectives via Clipping and Normalized Client Updates, *Federated Learning One World Seminar*, April 2022.
7. AI at Scale: Robustness and Security in Adversarial Environments, *The Center for Education and Research in Information Assurance and Security (CERIAS), Purdue University*, Oct. 2021.
8. Structured and Resource-Constrained Collaborative Learning, *Center for Innovation in Control, Optimization, and Networks (ICON), Purdue University*, Sep. 2021.
9. Structured and Resource-Constrained Collaborative Learning, *Department of Computer Science, Purdue University*, Sep. 2021.
10. Weak Submodular Optimization: Theory, Algorithm, Application, *Department of Computer Science at UIUC*, Feb. 2020.
11. Progressive Stochastic Greedy Sparse Reconstruction and Support Selection, *15th CSL student conference at UIUC*, Feb. 2020.
12. Tutorial on Submodular Maximization, *The Oden Institute for Computational Engineering and Sciences at UT Austin*, Nov. 2019.
13. Tutorial on Submodular Minimization, *The Oden Institute for Computational Engineering and Sciences at UT Austin*, Oct. 2019.
14. Sparse Tensor Decomposition for Haplotype Assembly of Diploids and Polyploids, *12th CSL student conference at UIUC*, Feb. 2017.

PUBLICATIONS

Journal Papers

1. Lauffer, N., Ghasemi, M., Hashemi, A., Savas, Y., Topcu, U., *"No-Regret Learning in Dynamic Stackelberg Games,"* **IEEE Transactions on Automatic Control**, 2023.
2. Chellapandi, V., Upadhyay, A., Hashemi, A., Żak, S., *"On the Convergence of Decentralized Federated Learning Under Imperfect Information Sharing,"* **IEEE Control Systems Letters,** 2023.
3. Upadhyay, A., Hashemi, A., *"Improved Convergence Analysis and SNR Control Strategies for Federated Learning in the Presence of Noise,"* **IEEE Access,** 2023.
4. Kaya, E.*, Sahin, M.*, Hashemi, A., *"Communication-Efficient Zeroth-Order Distributed Online Optimization: Algorithm, Theory, and Applications,"* **IEEE Access,** 2023.

5. Hashemi*, A., Schaeffer*, H., Shi*, B., Tran*, G., Ward*, R., *"Generalization Bounds for Sparse Random Feature Expansions,"* **Applied and Computational Harmonic Analysis,** 2022.

6. Hashemi, A., Vikalo, H., de Veciana, G., *"On the Benefits of Progressively Increasing Sampling Sizes in Stochastic Greedy Weak Submodular Maximization,"***IEEE Transactions on Signal Processing,** 2022.

7. Ghasemi, M., Hashemi, A., Vikalo, H., Topcu, U., *"Learning in Markov Decision Processes with Varying Rewards: High Probability Regret Bounds under Bandit Feedback and Unknown Horizon,"* **IEEE Transactions on Automatic Control (conditionally accepted),** 2022.

8. Hashemi, A., Shafipour, R., Vikalo, H., Mateos, G., *"Towards Accelerated Greedy Sampling and Reconstruction of Bandlimited Graph Signals,"* **Signal Processing,** 2022.

9. Chen, Y., Hashemi, A., Vikalo, H., *"Communication-Efficient Variance-Reduced Decentralized Stochastic Optimization over Time-Varying Directed Graphs,"* **IEEE Transactions on Automatic Control,** 2022.

10. Hashemi, A., Acharya*, A., Das*, R., Vikalo, H., Sanghavi, S., Dhillon, I., *"On the Benefits of Multiple Gossip Steps in Communication-Constrained Decentralized Federated Learning,"* **IEEE Transactions on Parallel and Distributed Systems, Special Section on Parallel and Distributed Computing Techniques for AI, ML, and DL,** 2021.

11. Hashemi, A., Ghasemi, M., Vikalo, H., Topcu, U., *"Randomized Greedy Sensor Selection: Leveraging Weak Submodularity,"* **IEEE Transactions on Automatic Control**, Jan. 2021.

12. Hashemi, A. and Vikalo, H., *"Evolutionary Self-Expressive Models for Subspace Clustering,"* **IEEE Journal of Selected Topics in Signal Processing, Special Issue on Data Science: Robust Subspace Learning and Tracking,** vol. 12, no. 6, pp. 1534–1546, Dec. 2018.

13. Hashemi, A. and Vikalo, H., *"Accelerated Orthogonal Least-Squares for Large-Scale Sparse Reconstruction,"* **Digital Signal Processing,** vol. 82, pp. 91–105, Nov. 2018.

14. Hashemi, A., Zhu, B., Vikalo, H., *"Sparse Tensor Decomposition for Haplotype Assembly of Diploids and Polyploids,"* **BMC Genomics,** vol. 19, no. 4, pp. 1–15, Mar. 2018.

Conference Papers

1. Sahin, M.*, Yalcinkaya, D.*, Hashemi, A., Dharmakumar, R., Sharif, B., *"Realistic Phase Map Synthesis from Magnitude-only Images via Score-Based Diffusion Models to Generate Large Training Datasets for Deep Learning-based Image Reconstruction,"* **27th Annual Scientific Sessions of SCMR,** 2024.

2. Aketi, A., Hashemi, A., Roy, K., *"Global Update Tracking: A Decentralized Learning Algorithm for Heterogeneous Data,"* **Conference on Neural Information Processing Systems (NeurIPS),** 2023.

3. Kaya, E., Hashemi, A., *"Relative Entropy Regularization for Robust Submodular Multi-Task Subset Selection,"* **Allerton Conference on Communication, Control, and Computing,** 2023.

4. Ramishetty, S., Hashemi, A., *"High Probability Guarantees for Federated Learning,"* **Allerton Conference on Communication, Control, and Computing,** 2023.

5. Castillo, A., Kaya, E., Hashemi, A., *"High Probability Guarantees for Submodular Maximization via Boosted Stochastic Greedy,"* **57th Asilomar Conference on Signals, Systems, and Computers,** 2023.

6. Hashemi, A., A. Upadhyay, *"Predictive Estimation for Reinforcement Learning with Time-Varying Reward Functions,"* **57th Asilomar Conference on Signals, Systems, and Computers,** 2023.

7. Upadhyay, A., Hashemi, A., *"Noisy Communication of Information in Federated Learning: An Improved Convergence Analysis,"* **57th Asilomar Conference on Signals, Systems, and Computers,** 2023.

8. Kaya*, E., Sahin*, M., Hashemi, A., *"Communication-Constrained Exchange of Zeroth-Order Information with Application to Collaborative Target Tracking,"* **International Conference on Acoustics, Speech and Signal Processing (ICASSP),** 2023.

9. Chen, Y., Hashemi, A., Vikalo, H., *"Accelerated Decentralized Stochastic Non-Convex Optimization over Directed Networks,"* **International Conference on Acoustics, Speech and Signal Processing (ICASSP),** 2023.

10. Yalcinkaya, D., Benan Unal, H., Raman, S., Hashemi, A., Dharmakumar, R., Sharif, B., *"Data-adapted Neural Network Denoisers as a Regularization Engine for Low-latency Image Reconstruction in Accelerated Cardiac Perfusion MRI,"* **31st Annual Meeting of ISMRM,** 2023.

11. Hibbard, M., Hashemi, A., Tanaka, T., Topcu, U., *"Randomized Greedy Algorithms for Sensor Selection in Large-Scale Satellite Constellations,"* **American Control Conference (ACC),** 2023.

12. Das, R., Hashemi, A., Sanghavi, S., Dhillon, I., *"DP-NormFedAvg: Normalizing Client Updates for Privacy-Preserving Federated Learning,"* **14th International Workshop on Optimization for Machine Learning at NeurIPS,** 2022.

13. Das, R., Hashemi*, A., Acharya*, A., Sanghavi, S., Dhillon, I., Topcu, U., *"Faster Non-Convex Federated Learning via Global and Local Momentum,"* **Conference on Uncertainty in Artificial Intelligence (UAI),** 2022.

14. Acharya, A., Hashemi, A., Jain, P., Sanghavi, S., Dhillon, I., Topcu, U., *"Robust SGD via Block coordinate Geometric Median Descent,"* **International Conference on Artificial Intelligence and Statistics (AISTATS),** 2022.

15. Ghasemi*, M., Hashemi*, A., Vikalo, H., Topcu, U., *"No-Regret Learning with High-Probability in Adversarial Markov Decision Processes,"* **Conference on Uncertainty in Artificial Intelligence (UAI),** 2021.

16. Ghasemi, M., Hashemi, A., Topcu, U., Vikalo, H., *"Online Learning with Implicit Exploration in Episodic Markov Decision Processes,"* **American Control Conference (ACC),** 2021.

17. Savas, Y., Hashemi, A., Vinod, AP., Sadler, BM., Topcu, U., *"Physical-Layer Security via Distributed Beam-forming in the Presence of Adversaries with Unknown Locations,"* **International Conference on Acoustics, Speech and Signal Processing (ICASSP),** 2021.

18. Chen, Y., Hashemi, A., Vikalo, H., *"Decentralized Optimization on Time-Varying Directed Graphs under Communication Constraints,"* **International Conference on Acoustics, Speech and Signal Processing (ICASSP),** 2021.

19. Hashemi, A., Vikalo, H., de Veciana, G., *"On the Performance-Complexity Tradeoff in Stochastic Greedy Weak Submodular Optimization,"* **International Conference on Acoustics, Speech and Signal Processing (ICASSP),** 2021.

20. Ghasemi, M., Hashemi, A., Vikalo, H., Topcu, U., *"Identifying Low-Dimensional Structures in Markov Chains: A Nonnegative Matrix Factorization Approach,"* **American Control Conference (ACC),** 2020.

21. Ghasemi*, M., Hashemi*, A., Vikalo, H., Topcu, U., *"On Submodularity of Quadratic Observation Selection in Constrained Networked Sensing Systems,"* **American Control Conference (ACC),** 2019.

22. Shafipour, R., Hashemi, A., Mateos, G., Vikalo, H., *"Online Topology Inference from Streaming Stationary Graph Signals,"* **Data Science Workshop (DSW)**, 2019.

23. Hashemi, A., Ghasemi, M., Vikalo, H., Topcu, U., *"Submodular Observation Selection and Information Gathering for Quadratic Models,"* **International Conference on Machine Learning (ICML)**, June 2019.

24. Hashemi, A. and Vikalo, H., *"Evolutionary Subspace Clustering: Discovering Structure In Self-expressive Time-series Data,"* **International Conference on Acoustic, Speech and Signal Processing,** 2019.

25. Consul, S., Hashemi, A., Vikalo, H., *"A MAP Framework for Support Recovery of Sparse Signals Using Orthogonal Least Squares,"* **International Conference on Acoustic, Speech and Signal Processing**

(ICASSP), 2019.

26. Hashemi*, A., Kilic*, O.F., Vikalo, H., *"Near-Optimal Distributed Estimation for a Network of Sensing Units Operating Under Communication Constraints,"* **Conference on Decision and Control (CDC),** 2018.

27. Hashemi, A., Shafipour, R., Vikalo, H., Mateos, G., *"A Novel Scheme for Support Identification and Iterative Sampling of Bandlimited Graph Signals,"* **Global Conference on Signal and Information Processing (GlobalSIP),** 2018.

28. Hashemi, A., Ghasemi, M., Vikalo, H., Topcu, U., *"A Randomized Greedy Algorithm for Near-Optimal Sensor Scheduling in Large-Scale Sensor Networks,"* **American Control Conference (ACC),** 2018.

29. Hashemi, A., Shafipour, R., Vikalo, H., Mateos, G., *"Sampling and Reconstruction of Graph Signals via Weak Submodularity and Semidefinite Relaxation,"* **International Conference on Acoustic, Speech and Signal Processing (ICASSP),** 2018.

30. Hashemi, A., Zhu, B., Vikalo, H., *"Sparse Tensor Decomposition for Haplotype Assembly of Diploids and Polyploids,"* **International Workshop on Computational Network Biology: Modeling, Analysis, Control (CNB-MAC),** 2017.

31. Hashemi, A. and Vikalo, H., *"Sparse Recovery via Branch and Bound Least-Squares,"* **International Conference on Acoustic, Speech and Signal Processing (ICASSP),** 2017.

32. Hashemi, A. and Vikalo, H., *"Sparse Linear Regression via Generalized Orthogonal Least-Squares,"* **Global Conference on Signal and Information Processing (GlobalSIP),** 2016.

SCHOLASTIC HONORS

- Outstanding Reviewer of ICML 2020, August 2020
- 1 of 4 selected as an invited student speaker at 15th CSL conference at UIUC, Machine Learning for Signal Processing session, February 2020
- Selected as the Schmidt Science Fellows Award nominee from UT Austin, 2019
- Best student paper award finalist, American Control Conference, June 2018
- 1 of 4 selected as an invited student speaker at 12th CSL conference at UIUC, Bioinformatics and Computational Genomics session, February 2017
- Travel awards for ICML 2019, ACC 2019, ACC 2018, CNB-MAC 2017, ICASSP 2017, GlobalSIP 2016
- Inclusive Classrooms Leadership Certificate, UT Austin, February 2015
- Professional Teaching Assistant Certificate, UT Austin, August 2014
- Qualied as an Exceptional Talent eligible to enter Graduate Studies without entrance exam, Sharif University of Technology, 2013
- Ranked 79th among more than 277,000 participants in the Nationwide University Entrance Exam for B.Sc. degree, 2010
- Recipient of Iranian National Elite Foundation fellowship, 2010-2014

TEACHING EXPERIENCE

Purdue University
Elmore Family School of Electrical and Computer Engineering
Instructor

- ECE 69500: Optimization for Deep Learning
(Fall 2022, Fall 2023)

- ECE 20001: Electrical Engineering Fundamental I
  (Fall 2021, Spring 2022, Spring 2023, Spring 2024)
- Vertically Integrated Projects (VIP): Team RoboMaster
  (Fall 2022, Spring 2023, Fall 2023, Spring 2024)

University of Texas at Austin
Department of Electrical and Computer Engineering
Graduate Teaching Assistant

- Statistical Machine Learning — Fall 2019
- Estimation Theory — Fall 2017
- Digital Signal Processing — Spring 2015
- Digital Signal Processing — Fall 2014

Sharif University of Technology
Department of Electrical Engineering
Undergraduate Teaching Assistant

- Digital Signal Processing — Fall 2013
- Communication Systems — Fall 2013
- Principles of Electronics — Fall 2013
- Principles of Electronics — Spring 2013
- Computer Architecture — Spring 2013
- Logic Circuits — Spring 2013
- Analog Circuits — Spring 2013
- Electromagnetism — Fall 2012

ADVISING

Postdoctoral Scholars

- Jonggwang Kim (Since January 2024), Co-adviser: Prof. Christopher G. Brinton

Ph.D. Students

- Antesh Upadhyay (since December 2021)
- Ege Kaya (since August 2022)
- Andres C Castillo (since August 2022)
- Zhankun Luo (since August 2023)
- Mehmet Berk Sahin (since August 2022), Co-adviser: Prof. Behzad Sharif
- Sang Bin Moon (since August 2022), Co-adviser: Prof. Jan-Anders Mansson
- Dilek Yalcinkaya (since August 2022), Co-advised with Prof. Behzad Sharif

M.Sc. Students with Thesis

- Sravani Ramishetty, (December 2021 - August 2023)
  Thesis: *High Probability Guarantees for Federated Learning*

Other Advising Roles

- Actively advising undergraduates through programs such as SURF, Summer Stay, and OUR Scholars
- Serving on the dissertation committee of 12 PhD students.
- Faculty advisor for Purdue RoboMaster Club

SERVICES AT THE PURDUE UNIVERSITY

- Member of the ECE Graduate Committee — Fall 2023–present
- Core Member of the ECE Graduate Admissions Committee, CNSIP area — Fall 2023–present
- Member of the SME Committee for PMP students — Fall 2022 – present
- Member of the graduate admissions committee, CNSIP and CE areas — 2021–2022
- Co-organizer of ICON and ECE Seminars — 2022

PROFESSIONAL MEMBERSHIPS AND SERVICES

Grant Proposal Panels

- NSF, 2023
- USDA NIFA SBIR Phase I grants program, 2023

Conference/Workshop Organizer

- Panelist in TRIPODS Postdoc Workshop, Toyota Technological Institute at Chicago August, 2023
- EnCORE Institute Sessions on "Distributed Learning and Decision-Making" at ITA 2023

Technical Program Committee

- Networks and Communication Systems Technical Committee — October 2022 – present
  IEEE Control Systems Society

Conference Area Chair

- 27th International Conference on Artificial Intelligence and Statistics (AISTATS) — 2024
- 26th International Conference on Artificial Intelligence and Statistics (AISTATS) — 2023
- International Conference on Images, Signals, and Computing (ICISC) — 2023
- International Workshop on Signal Processing Advances in Wireless Communications (SPAWC) — 2020
- International Multi-Conference on Computing in the Global Information Technology — 2019
- International Conference on Mobile, Hybrid, and Online Learning — 2019
- International Conference on Advanced Engineering Computing and Applications in Sciences — 2018
- International Multi-Conference on Computing in the Global Information Technology — 2018

Professional Society Memberships

- Institute of Electrical and Electronics Engineers (IEEE), Signal Processing Society — 2016 – present
- Society for Industrial and Applied Mathematics (SIAM) — 2016 – present

Journal Reviews

- IEEE Control Systems Letters
- IEEE Signal Processing Magazine
- IEEE Transactions on Signal Processing

- IEEE Signal Processing Letters
- IEEE Transactions on Signal and Information Processing over Networks
- Elsevier Signal Processing
- IET Signal Processing
- IEEE Transactions on Robotics
- IEEE Transactions on Control of Networked Systems
- IEEE Transactions on Automatic Control
- Automatica
- IEEE Transactions on Wireless Communications
- IEEE Transactions on Communications
- IEEE Transactions on Cybernetics
- IEEE Journal of Selected Areas in Information Theory
- IEEE Access
- Information Sciences
- SIAM Journal on Scientific Computing
- Nature Scientific Reports
- PLOS One
- Taylor and Francis Journal on Forensic Sciences Research

Conference Reviews

- International Conference on Acoustics, Speech and Signal Processing (ICASSP) 2023
- International Conference on Artificial Intelligence and Statistics (AISTATS) 2021, 2024
- International Conference on Machine Learning (ICML) 2020, 2021, 2022, 2023
- Conference on Neural Information Processing Systems (NeurIPS) 2020, 2022
- American Control Conference (ACC) 2020, 2021, 2022
- International Symposium on Information Theory (ISIT) 2020
- International Workshop on Signal Processing Advances in Wireless Communications (SPAWC) 2020
- Conference on Decision and Control (CDC) 2018, 2023
- International Conference on Image Processing (ICIP) 2022, 2023

SHORT BIO

Abolfazl Hashemi received the B.Sc. degree in Electrical Engineering from the Sharif University of Technology, Iran, in July 2014, and the M.S.E. and Ph.D. degrees in Electrical and Computer Engineering from the University of Texas at Austin, USA, in May 2016 and August 2020, respectively. From August 2020 to August 2021 he was a Postdoctoral Scholar at the Oden Institute for Computational Engineering and Sciences at the University of Texas at Austin. Since August 2021, he has been an Assistant Professor at the Elmore Family School of Electrical and Computer Engineering at Purdue University. Abolfazl was the 2019 Schmidt Science Fellows Award nominee from UT Austin, the recipient of the Iranian National Elite Foundation Fellowship, and a Best Student Paper Award finalist at the 2018 American Control Conference. His research interests include optimization for machine learning, signal processing, and control.

Last Update: 19th Nov, 2023