ABOLFAZL HASHEMI

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CURRENT POSITION

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

- Communications, Networking, Signal and Image Processing
- Computer Engineering (Artificial Intelligence)

Affiliations

- Director of Machine Intelligence and Networked Data Science Lab (MINDS)
- Center for Innovation in Control, Optimization, and Networks (ICON)
- The Center for Education and Research in Information Assurance and Security (CERIAS)

RESEARCH DESCRIPTION

My research interests include:

- Signal Processing
- Machine Learning
- Distributed Learning
- Online Learning

The goal of my research is to enhance the performance and capabilities of the networked decision making systems characterized by limited communication budget and data scarcity. In doing so, I design efficient algorithms with mathematical guarantees to render practical deployment of collaborative systems possible in applications including bioinformatics, reinforcement learning, supervised learning, and dynamical systems.

EDUCATION

Doctor of Philosophy (Ph.D.), Electrical and Computer Engineering — 2016 – 2020
University of Texas at Austin, Austin, Texas, USA
Dissertation: Efficient Algorithms for Structured Inference and Collaborative Learning
Advisor: Prof. Haris Vikalo
Committee: Prof. Alex Dimakis, Prof. Gustavo de Veciana, Prof. Sujay Sanghavi, Prof. Qiang Liu

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

Bachelor of Science (B.S.), Electrical Engineering — 2010 – 2014
Sharif University of Technology, Tehran, Iran
Thesis: Vision-Based Gait Analysis via Exploiting Human Body-Parts Proportion
Advisor: Prof. Babak H. Khalaj

RESEARCH EXPERIENCE

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

- Adversarial training strategies for robust inverse reinforcement learning

- Communication-efficient and optimal stochastic optimization algorithms for federated learning and multi-agent reinforcement learning
- Scalable algorithms and communication strategies for robust distributed optimization in adversarial environments
- Online learning algorithms for sequential decision making and Stackelberg games with time-varying tasks in adversarial environments
- Structure-aware function approximation and identification of governing equations using sparse random Fourier features

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

- Efficient communication strategies for network optimization
- Submodular observation selection and information gathering for collaborative sensing systems
- Evolutionary self-expressive models for subspace clustering with applications to real-time motion segmentation and formation of ocean water masses
- Sparse tensor decomposition algorithms for haplotype assembly and study of genetic variations
- Greedy schemes for sparse reconstruction and sparse learning

Data Scientist Intern
Cognitive Scale, Austin, Texas Summer 2017
Mentor: Dr. Suyog Dutt Jain
Project: Relation extraction for clinical text data using attention-based deep recurrent neural networks

Undergraduate Research Intern
Hong Kong University of Science and Technology Summer 2013
Department of Electrical and Computer Engineering
Host: Prof. Daniel Palomar
Project: Robust estimation of covariance matrices from heavy-tailed distributions

Undergraduate Research Assistant
Sharif University of Technology 2013 – 2014
Department of Electrical Engineering
Advisor: Prof. Babak H. Khalaj
Project: Vision-based gait analysis via exploiting human body-parts proportion

SCHOLASTIC HONORS

1. Best student paper award finalist, American Control Conference, June 2018
2. 1 of 4 selected as an invited student speaker at 15th CSL conference at UIUC, Machine Learning for Signal Processing session, February 2020
3. 1 of 4 selected as an invited student speaker at 12th CSL conference at UIUC, Bioinformatics and Computational Genomics session, February 2017
4. Selected as the Schmidt Science Fellows Award nominee from UT Austin, 2019
5. Inclusive Classrooms Leadership Certificate, UT Austin, February 2015
6. Professional Teaching Assistant Certificate, UT Austin, August 2014
7. Top 33% Reviewer of ICML 2020, August 2020

8. Travel awards for ICML 2019, ACC 2019, ACC 2018, CNB-MAC 2017, ICASSP 2017, GlobalSIP 2016
9. Qualied as an Exceptional Talent eligible to enter Graduate Studies without entrance exam, Sharif University of Technology, 2013
10. Ranked 79th among more than 277,000 participants in the Nationwide University Entrance Exam for B.Sc. degree, 2010
11. Recipient of Iranian National Elite Foundation fellowship, 2010-2014

TEACHING EXPERIENCE

Instructor
Purdue University
Elmore Family School of Electrical and Computer Engineering

- ECE 20001: Electrical Engineering Fundamental I — Spring 2022
- ECE 20001: Electrical Engineering Fundamental I — Fall 2021

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

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

Undergraduate Teaching Assistant
Sharif University of Technology
Department of Electrical Engineering

- 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 ROLES

Ph.D. Dissertation Committee

- Yiuye Chen, Ph.D. student at UT Austin
- Zhan-Lun Chang, Ph.D. student at Purdue
- Henry Su Wang, Ph.D. student at Purdue

Master Students

- Antesh U, Master student at Purdue — Since December 2021
- Sravani Ramishetty, Master student at Purdue — Since December 2021

Undergraduate Students

- John Stanwick, Undergraduate student at Purdue — Since October 2021
- Alexander Zimbalist, Undergraduate student at Purdue — Since October 2021

Mentorship

- Niklas Lauffer (Undergrad, UT Austin): No-Regret Learning in Dynamic Stackelberg Games (now at UC Berkeley), Spring and Summer 2021
- Bobby Shi (Ph.D. student, UT Austin): Sparse random features for function approximation and identification of dynamical systems, 2020
- Rudrajit Das (Ph.D. student, UT Austin): Communication-efficient and privacy-preserving federated learning, since Summer 2020
- Anish Acharya (Ph.D. student, UT Austin): Robust federated learning and distributed optimization in high dimensions, since Summer 2020
- Yiuye Chen (Ph.D. student, UT Austin): Distributed optimization over resource-constrained networks, since Fall 2019
- Émilie Thomé (Intern at Oden Institute, UT Austin): Communication-efficient multi-task learning and sequential decision making, since Spring 2021
- Banghua Zhu (Visiting undergrad from Tsinghua, UT Austin): Sparse tensor decomposition for haplotype assembly (now at UC Berkeley), Fall 2017
- Hussain Almattar (Visiting undergrad from KAUST, UT Austin): Distributed vs. federated learning: Exploring the trade-offs in collaborative learning schemes, Summer 2019

Other Mentorship Roles

- COMPES: Coaching and Mentoring for Purdue ECE Students, since October 2021
- Faculty advisor for Plurimos LLP, since October 2021
- Faculty advisor for Purdue RoboMaster Club, since December 2021

INVITED TALKS

1. AI at Scale: Robustness and Security in Adversarial Environments, *The Center for Education and Research in Information Assurance and Security, Purdue University*, Oct. 2021.
2. Structured and Resource-Constrained Collaborative Learning, *Center for Innovation in Control, Optimization, and Networks, Purdue University*, Sep. 2021.
3. Structured and Resource-Constrained Collaborative Learning, *Department of Computer Science, Purdue University*, Sep. 2021.
4. Structured and Resource-Constrained Collaborative Learning, *School of Electrical and Computer Engineering, Purdue University*, Apr. 2021.
5. Structured and Resource-Constrained Collaborative Learning, *School of Electrical and Computer Engineering, Pennsylvania State University*, Mar. 2021.
6. Weak Submodular Optimization: Theory, Algorithm, Application, *Department of Computer Science at UIUC*, Feb. 2020.
7. Progressive Stochastic Greedy Sparse Reconstruction and Support Selection, *15th CSL student conference at UIUC*, Feb. 2020.
8. Tutorial on Submodular Maximization, *The Oden Institute for Computational Engineering and Sciences at UT Austin*, Nov. 2019.

9. Tutorial on Submodular Minimization, *The Oden Institute for Computational Engineering and Sciences at UT Austin*, Oct. 2019.

10. Sparse Tensor Decomposition for Haplotype Assembly of Diploids and Polyploids, *12th CSL student conference at UIUC*, Feb. 2017.

PUBLICATIONS

Preprints

1. Lauffer, N., Savas, Y., Ghasemi, M., **Hashemi, A.**, Topcu, U., "No-Regret Learning in Dynamic Stackelberg Games," *Submitted*, 2021.

2. Memarian, F., **Hashemi, A.**, Niekum, S., Topcu, U., "Robust Generative Adversarial Imitation Learning via Local Lipschitzness," *Submitted,* 2021.

3. Das, R., **Hashemi, A.**, Sanghavi, S., Dhillon, I., "DP-NormFedAvg: Normalizing Client Updates for Privacy-Preserving Federated Learning," *Submitted,* 2021.

4. **Hashemi*, A.**, Schaeffer*, H., Shi*, B., Tran*, G., Ward*, R., "Function Approximation via Sparse Random Features," *Submitted,* 2021.

5. Acharya, A., **Hashemi, A.**, Jain, P., Sanghavi, S., Dhillon, I., Topcu, U., "Robust SGD via Block coordinate Geometric Median Descent," *Submitted,* 2021.

6. Das, R., **Hashemi*, A.**, Acharya*, A., Sanghavi, S., Dhillon, I., Topcu, U., "Faster Non-Convex Federated Learning via Global and Local Momentum," *Submitted,* 2021.

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," *Submitted*, 2021.

8. **Hashemi, A.**, Vikalo, H., de Veciana, G., "Performance-Complexity Tradeoffs in Greedy Weak Submodular Maximization with Random Sampling," *Submitted,* 2021.

9. **Hashemi, A.**, Shafipour, R., Vikalo, H., Mateos, G., "Towards Accelerated Greedy Sampling and Reconstruction of Bandlimited Graph Signals," *Submitted,* 2021.

Journal Papers

1. **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,* 2022.

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

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

4. **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.

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

6. **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. 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.

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

3. 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.

4. 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.

5. **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.

6. 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.

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

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

9. **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.

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

11. 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),* Brighton, 2019.

12. **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.

13. **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.

14. **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 **(Best student paper award finalist).**

15. **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.

16. **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.

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

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

PROFESSIONAL MEMBERSHIPS AND SERVICES

Technical Program Committees

- IEEE International Workshop on Signal Processing Advances in Wireless Communications 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

Memberships

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

Journal Reviews

- IEEE Transactions on Robotics
- 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 Automatic Control
- Automatica
- IEEE Transactions on Wireless Communications
- IEEE Transactions on Communications
- IEEE Transactions on Cybernetics
- IEEE Journal of Selected Areas in Information Theory
- SIAM Journal on Scientific Computing
- IEEE Access
- Nature Scientific Reports
- PLOS One
- Taylor and Francis Journal on Forensic Sciences Research

Conference Reviews

- International Conference on Artificial Intelligence and Statistics (AISTATS) 2021
- International Conference on Machine Learning (ICML) 2020 & 2021
- Conference on Neural Information Processing Systems (NeurIPS) 2020
- 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