# ARYAN MOKHTARI

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## RESEARCH INTERESTS

Optimization, Machine Learning, Data Science, Artificial Intelligence, and Signal Processing.

## Appointments

**Department of Electrical and Computer Engineering, UT Austin** — Austin, TX
Assistant Professor — August 2019 - Present

**Laboratory for Information and Decision Systems (LIDS), MIT** — Cambridge, MA
Postdoctoral Associate — January 2018 - July 2019
*Hosts*: Prof. Asu Ozdaglar and Prof. Ali Jadbabaie

**Simons Institute for the Theory of Computing, UC Berkeley** — Berkeley, CA
Research Fellow — August 2017 - December 2017
*Program*: "Bridging Continuous and Discrete Optimization"

## EDUCATION

**University of Pennsylvania** — Philadelphia, PA
Ph.D. in Electrical & Systems Engineering — August 2017
*Advisor*: Prof. Alejandro Ribeiro
*Thesis*: "Efficient Methods for Large-Scale Empirical Risk Minimization"

**University of Pennsylvania (The Wharton School)** — Philadelphia, PA
A.M. in Statistics — August 2017

**University of Pennsylvania** — Philadelphia, PA
M.Sc. in Electrical Engineering — May 2014

**Sharif University of Technology** — Tehran, Iran
B.Sc. in Electrical Engineering — June 2011

## INDUSTRY EXPERIENCES

**YAHOO! (Big-data Machine Learning group)** — Sunnyvale, CA
Research Intern (Intern III) (with Dr. Amir Ingber and Dr. Andrew Feng) — Summer 2016

**Advanced Digital Sciences Center (Research affiliate of UIUC at Singapore)** — Singapore, Singapore
Research Scholar (with Prof. David K. Y. Yau and Prof. Richard T. B. Ma) — Summer 2010

## HONORS and AWARDS

- Joseph and Rosaline Wolf Best Doctoral Dissertation Award — Fall 2018
  (Awarded by the ESE Department of the University of Pennsylvania)
- Research Fellowship from the Simons Institute at UC Berkeley — Fall 2017
  (Program: "Bridging Continuous and Discrete Optimization")
- Travel grant from Center for Discrete Math and Theoretical Computer Sci. (DIMACS) — Summer 2017
- University of Pennsylvania GAPSA research travel grant — Fall 2016
- Departmental Fellowship, UPenn — Spring 2012

PUBLICATIONS

## Thesis

1. **A. Mokhtari**, "Efficient Methods for Large-Scale Empirical Risk Minimization," Ph.D. Dissertation, University of Pennsylvania, 2017. (**Joseph and Rosaline Wolf Best Doctoral Dissertation Award**). [pdf]

## Preprints

1. **A. Mokhtari**, A. Ozdaglar, and S. Pattathil. "Convergence Rate of $O(1/k)$ for Optimistic Gradient and Extra-gradient Methods in Smooth Convex-Concave Saddle Point Problems," 2019. [pdf]
2. A. Reisizadeh, H. Taheri, **A. Mokhtari**, H. Hassani, and R. Pedarsani, "Robust and Communication-Efficient Collaborative Learning," 2019.
3. H. Hassani, A. Karbasi, **A. Mokhtari**, Z. Shen. "Stochastic Continuous Greedy ++: When Upper and Lower Bounds Match," 2019.
4. W. Liu, **A. Mokhtari**, A. Ozdaglar, S. Pattathil, Z. Shen, and N. Zheng. "A Decentralized Proximal Point-type Method for Saddle Point Problems," 2019.
5. **A. Mokhtari**, A. Ozdaglar, and S. Pattathil. "A Unified Analysis of Extra-gradient and Optimistic Gradient Methods for Saddle Point Problems: Proximal Point Approach," 2019. [pdf]
6. M. Zhang, L. Chen, **A. Mokhtari**, H. Hassani, and A. Karbasi. "Quantized Frank-Wolfe: Faster Optimization, Lower Communication, and Projection Free," 2019. [pdf]
7. A. Reisizadeh, **A. Mokhtari**, H. Hassani, and R. Pedarsani, "An Exact Quantized Decentralized Gradient Descent Algorithm," 2019. [pdf]
8. **A. Mokhtari**, H. Hassani, and A. Karbasi, "Stochastic Conditional Gradient Methods: From Convex Minimization to Submodular Maximization," 2018. [pdf]
9. M. Eisen, **A. Mokhtari**, and A. Ribeiro. A Primal-Dual Quasi-Newton Method for Exact Consensus Optimization, 2018. [pdf]
10. **A. Mokhtari**, A. Koppel, M. Takac, and A. Ribeiro, "A Class of Parallel Doubly Stochastic Algorithms for Large-Scale Learning," 2018. [pdf]

## Journal Papers

1. S. Paternain, **A. Mokhtari**, and A. Ribeiro, "A Newton-based Method for Nonconvex Optimization with Fast Evasion of Saddle Points," *SIAM Journal on Optimization*, vol. 29, no. 1, pp. 343-368, 2019. [pdf]
2. **A. Mokhtari**, M. Eisen, and A. Ribeiro, "IQN: An Incremental Quasi-Newton Method with Local Superlinear Convergence Rate," *SIAM Journal on Optimization*, vol. 28, no. 2, pp. 1670–1698, 2018. [pdf]
3. **A. Mokhtari**, M. Gürbüzbalaban, and A. Ribeiro, "Surpassing Gradient Descent Provably: A Cyclic Incremental Method with Linear Convergence Rate," *SIAM Journal on Optimization*, vol. 28, no. 2, pp. 1420–1447, 2018. [pdf]
4. A. Simonetto, A. Koppel, **A. Mokhtari**, G. Leus, and A. Ribeiro, "Decentralized Prediction-Correction Methods for Networked Time-Varying Convex Optimization," *IEEE Transactions on Automatic Control*, vol. 62, no. 11, pp. 5724-5738, Nov. 2017. [pdf]
5. T. Chen, **A. Mokhtari**, X. Wang, A. Ribeiro, and G. B. Giannakis, "Stochastic Averaging for Constrained Optimization with Application to Online Resource Allocation," *IEEE Trans. on Signal Process.*, vol. 65, no. 12, pp. 3078-3098, June 15, 15 2017. [pdf]
6. M. Eisen, **A. Mokhtari**, and A. Ribeiro, "Decentralized Quasi-Newton Methods," *IEEE Trans. on Signal Process.*, vol. 65, no. 10, pp. 2613-2628, May15, 15 2017. [pdf]

7. **A. Mokhtari**, Q. Ling, and A. Ribeiro, "Network Newton Distributed Optimization Methods," *IEEE Trans. on Signal Process.*, vol. 65, no. 1, pp. 146-161, Jan.1, 1 2017. [pdf]

8. **A. Mokhtari** and A. Ribeiro, "DSA: Decentralized Double Stochastic Averaging Gradient Algorithm," *Journal of Machine Learning Research*, 17(61):1-35, 2016. [pdf]

9. **A. Mokhtari**, W. Shi, Q. Ling, and A. Ribeiro, "A Decentralized Second-Order Method with Exact Linear Convergence Rate for Consensus Optimization," *IEEE Trans. Signal and Info. Process. over Networks*, vol. 2, no. 4, pp. 507-522, Dec. 2016. [pdf]

10. **A. Mokhtari**, W. Shi, Q. Ling, and A. Ribeiro, "DQM: Decentralized Quadratically Approximated Alternating Direction Method of Multipliers," *IEEE Trans. on Signal Process.*, vol. 64, no. 19, pp. 5158-5173, Oct. 1, 2016. [pdf]

11. A. Simonetto, **A. Mokhtari**, A. Koppel, G. Leus, and A. Ribeiro, "A Class of Prediction-Correction Methods for Time-Varying Convex Optimization," *in IEEE Transactions on Signal Processing*, vol. 64, no. 17, pp. 4576-4591, Sept.1, 1 2016. [pdf]

12. **A. Mokhtari** and A. Ribeiro, "Global Convergence of Online Limited Memory BFGS," *Journal of Machine Learning Research*, vol. 16, pp. 3151-3181, 2015. [pdf]

13. **A. Mokhtari** and A. Ribeiro, "RES: Regularized Stochastic BFGS Algorithm," *IEEE Trans. Signal Process.*, vol. 62, no. 23, pp. 6089 - 6104, December 2014. [pdf]

## Conference Papers

1. **A. Mokhtari**, A. Ozdaglar, and A. Jadbabaie, "Efficient Nonconvex Empirical Risk Minimization via Adaptive Sample Size Methods," *Int. Conference on Artificial Intelligence and Statistics (AISTATS)*, 2019. [pdf]

2. J. Zhang, C. Uribe, **A. Mokhtari**, and A. Jadbabaie, "Achieving Acceleration in Distributed Optimization via Direct Discretization of the Heavy-Ball ODE," *American Control Conference (ACC)*, 2019. [pdf]

3. **A. Mokhtari**, A. Ozdaglar, and A. Jadbabaie, "Escaping Saddle Points in Constrained Optimization," *in Advances in Neural Information Processing Systems (NeurIPS)*, pp. 3533-3643, 2018. (Spotlight: Top 4% of the submitted papers) [pdf] [Supplementary Material]

4. J. Zhang, **A. Mokhtari**, S. Sra, and A. Jadbabaie, "Direct Runge-Kutta Discretization Achieves Acceleration," *in Advances in Neural Information Processing Systems (NeurIPS)*, pp. 3901-3910, 2018. (Spotlight: Top 4% of the submitted papers) [pdf] [Supplementary Material]

5. A. Reisizadeh, **A. Mokhtari**, H. Hassani, and R. Pedarsani, "Quantized Decentralized Consensus Optimization, *IEEE 57th Conference on Decision and Control (CDC)*, 2018. [pdf]

6. S. Paternain, **A. Mokhtari**, and A. Ribeiro, "A Newton Method for Faster Navigation in Cluttered Environments, *IEEE 57th Conference on Decision and Control (CDC)*, 2018. [pdf]

7. **A. Mokhtari**, H. Hassani, and A. Karbasi, "Decentralized Submodular Maximization: Bridging Discrete and Continuous Settings", *International Conference on Machine Learning (ICML)*, PMLR 80:3613-3622, 2018. (Long talk) [pdf] [Supplementary Material]

8. Z. Shen, **A. Mokhtari**, H. Qian, P. Zhao, and T. Zhou, "Towards More Efficient Stochastic Decentralized Learning: Faster Convergence and Sparse Communication", *International Conference on Machine Learning (ICML)*, PMLR 80:4631-4640, 2018. [pdf] [Supplementary Material]

9. **A. Mokhtari**, H. Hassani, and A. Karbasi, "Conditional Gradient Method for Stochastic Submodular Maximization: Closing the Gap", *Proceedings of the Twenty-First International Conference on Artificial Intelligence and Statistics (AISTATS)*, PMLR 84:1886-1895, 2018.[pdf] [Supplementary Material]

10. Mark Eisen, **A. Mokhtari**, and A. Ribeiro, "Large Scale Empirical Risk Minimization via Truncated Adaptive Newton Method", *Proceedings of the Twenty-First International Conference on Artificial Intelligence and Statistics (AISTATS)*, PMLR 84:1447-1455, 2018. [pdf] [Supplementary Material]

11. A. Koppel, **A. Mokhtari**, and A. Ribeiro, "Parallel Stochastic Successive Convex Approximation Method for Large-Scale Dictionary Learning," *in Proc. Int. Conf. Acoustics Speech Signal Process. (ICASSP)*, Calgary,

Alberta, Canada, 2018. [pdf]

12. **A. Mokhtari** and A. Ribeiro, "First-Order Adaptive Sample Size Methods to Reduce Complexity of Empirical Risk Minimization", *in Advances in Neural Information Processing Systems (NeurIPS) 2017*, pp. 2057-2065, Long Beach, CA, December 4-9, 2017. [pdf] [Supplementary Material]

13. M. Eisen, **A. Mokhtari**, and A. Ribeiro, "A Primal-Dual Quasi-Newton Method for Consensus Optimization", *in 51th Asilomar Conference on Signals, Systems and Computers*, 2017, pp. 298-302. [pdf]

14. **A. Mokhtari**, M. Eisen, and A. Ribeiro, "An Incremental Quasi-Newton Method with a Local Superlinear Convergence Rate," *in Proc. Int. Conf. Acoustics Speech Signal Process. (ICASSP)*, New Orleans, LA, 2017, pp. 4039-4043. [pdf]

15. **A. Mokhtari**, M. Gürbüzbalaban, and A. Ribeiro, "A Double Incremental Aggregated Gradient Method with Linear Convergence Rate for Large-Scale Optimization," *in Proc. Int. Conf. Acoustics Speech Signal Process. (ICASSP)*, New Orleans, LA, 2017, pp. 4696-4700. [pdf]

16. **A. Mokhtari**, A. Koppel, G. Scutari, and A. Ribeiro, "Large-Scale NonConvex Stochastic Optimization by Doubly Stochastic Successive Convex Approximation," *in Proc. Int. Conf. Acoustics Speech Signal Process. (ICASSP)*, New Orleans, LA, 2017, pp. 4701-4705.[pdf]

17. **A. Mokhtari**, and A. Ingber, "A Diagonal-Augmented Quasi-Newton Method with Application to Factorization Machines," *in Proc. Int. Conf. Acoustics Speech Signal Process. (ICASSP)*, New Orleans, LA, 2017, pp. 2671-2675. [pdf]

18. **A. Mokhtari**, H. Daneshmand, A. Lucchi, T. Hofmann, and A. Ribeiro, "Adaptive Newton Method for Empirical Risk Minimization to Statistical Accuracy", *in Advances in Neural Information Processing Systems (NeurIPS) 2016*, pp. 4062-4070, Barcelona, Spain, Dec. 5-10, 2016. [pdf] [Supplementary Material]

19. T. Chen, **A. Mokhtari**, X. Wang, A. Ribeiro, and G. B. Giannakis, "A Data-driven Approach to Stochastic Network Optimization", *2016 IEEE Global Conference on Signal and Information Processing (GlobalSIP)*, Washington DC, DC, USA, 2016, pp. 510-514. [pdf]

20. H. Zhang, W. Shi, **A. Mokhtari**, A. Ribeiro, and Q. Ling, "Decentralized Constrained Consensus Optimization with Primal-Dual Splitting Projection", *2016 IEEE Global Conf. on Signal and Inform. Process. (GlobalSIP)*, Washington DC, DC, USA, 2016, pp. 565-569. [pdf]

21. M. Eisen, **A. Mokhtari**, and A. Ribeiro, "An Asynchronous Quasi-Newton Method for Consensus Optimization", *2016 IEEE Global Conference on Signal and Information Processing (GlobalSIP)*, Washington DC, DC, USA, 2016, pp. 570-574. [pdf]

22. **A. Mokhtari**, W. Shi, and Qing Ling, "ESOM: Exact Second-Order Method for Consensus Optimization," *50th Asilomar Conf. on Signals, Systems and Computers*, Pacific Grove, CA, 2016, pp. 783-787. [pdf]

23. A. Koppel, **A. Mokhtari**, and A. Ribeiro, "Doubly Stochastic Algorithms for Large-Scale Optimization," *50th Asilomar Conf. on Signals, Systems and Computers*, Pacific Grove, CA, 2016, pp. 1705-1709. [pdf]

24. **A. Mokhtari**, S. Shahrampour, A. Jadbabaie, and A. Ribeiro, "Online Optimization in Dynamic Environments: Improved Regret Rates for Strongly Convex Problems", *IEEE 55th Conf. on Decision and Control (CDC)*, pp. 7195-7201, Las Vegas, NV, 2016. [pdf]

25. **A. Mokhtari**, W. Shi, Q. Ling, and A. Ribeiro, "A Decentralized Second-Order Method for Dynamic Optimization", *IEEE 55th Conf. on Decision and Control (CDC)*, pp. 6036-6043, Las Vegas, NV, 2016. [pdf]

26. M. Eisen, **A. Mokhtari**, and A. Ribeiro,"A Decentralized Quasi-Newton Method for Dual Formulations of Consensus Optimization," *IEEE 55th Conf. on Decision and Control (CDC)*, pp. 1951-1958, Las Vegas, NV, 2016. [pdf]

27. A. Simonetto, A. Koppel, **A. Mokhtari**, G. Leus, and A. Ribeiro, "A Quasi-Newton Prediction-Correction Method for Decentralized Dynamic Convex Optimization," *European Control Conference (ECC)*, pp. 1934-1939, Aalborg, Denmark, 2016. [pdf]

28. **A. Mokhtari**, A. Koppel, and A. Ribeiro, "Doubly Random Parallel Stochastic Methods for Large Scale Learning," *American Control Conference (ACC)*, pp. 4847-4852, 2016. [pdf]

29. A. Simonetto, **A. Mokhtari**, A. Koppel, G. Leus, and A. Ribeiro, "A Decentralized Prediction-Correction Method for Networked Time-Varying Convex Optimization," *IEEE 6th International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP)*, pp. 509-512, 2015. [pdf]

30. **A. Mokhtari**, W. Shi, Q. Ling, and A. Ribeiro, "Decentralized Quadratically Approximated Alternating Direction Method of Multipliers", *in Proc. IEEE Global Conf. on Signal and Inform. Process.*, pp. 795-799, Orlando, FL, Dec. 14-16, 2015. [pdf]

31. A. Koppel, A. Simonetto, **A. Mokhtari**, G. Leus, and A. Ribeiro, "Target Tracking with Dynamic Convex Optimization," *in Proc. IEEE Global Conf. on Signal and Inform. Process.*, pp. 1210-1214, Orlando, FL, Dec. 14-16, 2015. [pdf]

32. **A. Mokhtari** and A. Ribeiro, "Decentralized Double Stochastic Averaging Gradient," *in Proc. Asilomar Conference on signals, systems, and computers*, pp. 406-410, 2015. [pdf]

33. A. Simonetto, A. Koppel, **A. Mokhtari**, G. Leus, and A. Ribeiro, "Prediction-Correction Methods for Time-Varying Convex Optimization," *in Proc. Asilomar Conference on signals, systems, and computers*, pp. 666-670, Pacific Grove, CA, Nov. 8-11, 2015. [pdf]

34. **A. Mokhtari**, Q. Ling, and A. Ribeiro, "An Approximate Newton Method for Distributed Optimization," *Proc. Int. Conf. Acoustics Speech Signal Process.*, pp. 2959-2963, 2015. [pdf]

35. **A. Mokhtari**, Q. Ling, and A. Ribeiro, "Network Newton," *in Proc. Asilomar Conf. on signals, systems, and computers*, pp. 1621-1625, Pacific Grove, CA, Nov. 2-5, 2014. [pdf]

36. **A. Mokhtari** and A. Ribeiro, "A Quasi-Newton Method for Large Scale Support Vector Machines," *in Proc. Int. Conf. Acoustics Speech Signal Process.*, pp. 8302-8306, 2014. [pdf]

37. **A. Mokhtari** and A. Ribeiro, "Regularized Stochastic BFGS algorithm," *in Proc. IEEE Global Conf. on Signal and Inform. Process.*, pp.1109-1112, Austin, TX, Dec, 2013. [pdf]

38. **A. Mokhtari** and A. Ribeiro, "A Dual Stochastic DFP Algorithm for Optimal Resource Allocation in Wireless Systems," *in Proc. IEEE Workshop on Signal Process. Advances in Wireless Commun. (SPAWC)*, pp. 21-25, Darmstadt, Germany, June 16-19, 2013. [pdf]

## MAJOR TALKS

- "Large-scale Optimization for Machine Learning and Data Scinece"
  **University of Illinois at Urbana-Champaign**, Computer Science Dept. , March 2019.
  **Johns Hopkins University**, Mathematical Institute for Data Science (MINDS), March 2019.
  **Georgia Tech**, Schools of Electrical and Computer Eng. & Industrial and Systems Eng., March 2019.
  **The University of Washington**, Industrial and Systems Eng. Dept., Feb 2019.
  **Rutgers Business School**, Management Science & Information Systems Dept., Feb 2019.
  **The University of Texas at Austin**, Electrical & Computer Engineering Dept., Feb 2019.
  **Rensselaer Polytechnic Inst. (RPI)**, Electrical, Computer, and Systems Engineering Dept., Jan 2019.
  **Purdue University**, Schools of Electrical and Computer Eng. & Industrial Eng., Jan 2019.
- "Achieving Acceleration via Direct Discretization of Heavy-Ball ODE"
  **Information Theory and Applications (ITA) Workshop**, February 2019.
- "Escaping Saddle Points in Constrained Optimization"
  **Informs Annual Meeting**, November 2018.
- "Achieving Acceleration via Direct Discretization of Heavy-Ball ODE"
  **DIMACS workshop on Optimization and Machine Learning**, August 2018. *(Invited Talk)*
- "Surpassing Gradient Descent Provably: A Linearly Convergent Cyclic Incremental Method"
  **Informs Annual Meeting**, October 2017. *(Invited Talk)*
- "Incremental Quasi-Newton Methods with Local Superlinear Convergence Rate"
  **International Conference Acoustics, Speech, and Signal Processing (ICASSP)**, March 2017.
- "Incremental Quasi-Newton Methods with Local Superlinear Convergence Rate"
  **Information Theory and Applications (ITA) Workshop** (Graduation Day), February 2017.
- "High-order methods for ERM"

**Google Tech Talk**, January 2017.

- "Online Optimization in Dynamic Environments"
  **Conference on Decision and Control (CDC)**, December 2016.
- "DQM: Decentralized Quadratically Approximated ADMM"
  **Informs Annual Meeting**, November 2016. *(Invited Talk)*
- "ESOM: Exact Second-Order Method for Consensus Optimization"
  **Asilomar Conference on Signals, Systems, and Computers**, November 2016.
- "Stochastic Quasi-Newton Methods"
  **Yahoo! Tech Talk**, August 2016.
- "DSA: A Decentralized Stochastic Averaging Method with Linear Convergence Rate"
  **INFORMS Optimization Society Conference 2016**, March 2016.
- "Decentralized Quadratically Approximated Alternating Direction Method of Multipliers"
  **IEEE Global Conference on Signal and Information Processing**, December 2015.
- "Decentralized Double Stochastic Averaging Gradient"
  **Asilomar Conference on Signals, Systems, and Computers**, November 2015.
- "Stochastic Quasi-Newton Methods"
  **ESE PhD Colloquia, UPenn**, October 2015.
- "Global Convergence of Stochastic Quasi-Newton Methods"
  **International Symposium on Mathematical Programming (ISMP)**, July 2015. *(Invited Talk)*
- "Network Newton"
  **Asilomar Conf. on Signals, Systems, & Computers**, November 2014.
- "Regularized Stochastic BFGS Algorithm"
  **IEEE Global Conference on Signal and Information Processing**, December 2013.

## PROFESSIONAL SERVICE

- Technical Program Committee (TPC) member of Global SIP 2017 and 2018
- Co-chair of:
  - Session on "Optimization for Machine Learning" at INFORMS Annual Meeting, 2018
  - Session on "Large-scale Optimization" at INFORMS Annual Meeting, 2018
  - Session on "Algorithms for Nonconvex Optimization" at INFORMS Optimization Society Conf., 2018
  - Session on "Submodular Maximization" at INFORMS Optimization Society Conf., 2018
  - Session on "Distributed Optimization and Learning" at Asilomar Conference, 2017
- Reviewer for the following journals:
  - SIAM Journal on Optimization (SIOPT), Mathematical Programming Journal, Journal of Machine Learning Research (JMLR), IEEE Transactions on Signal Processing (TSP), IEEE Transactions on Automatic Control (TAC), IEEE Transactions on Control of Network Systems (TCNS), IEEE Transactions on Signal and Information Processing over Networks (TSIPN), Journal of Selected Topics in Signal Processing (JSTSP), IEEE Transactions on Network Science and Engineering (TNSE), IEEE Signal Processing Letters (SPL)
- Reviewer for the following conferences:
  - Neural Information Processing Systems Conference (NeurIPS), International Conference on Machine Learning (ICML), International Conference on Artificial Intelligence and Statistics (AISTATS), IEEE American Control Conference (ACC), IEEE Conference on Decision and Control (CDC), IEEE Conference on Control Technology and Applications (CCTA), IEEE Global Conference on Signal and Information Processing (GlobalSIP)