KAIQING ZHANG

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EDUCATION

University of Illinois at Urbana-Champaign Aug. 2017 — Present
Ph.D. Candidate in Electrical and Computer Engineering
Overall GPA: 3.98/4.0

University of Illinois at Urbana-Champaign Jan. 2016 — Dec. 2017
M.S. in Applied Mathematics
Overall GPA: 4.0/4.0

University of Illinois at Urbana-Champaign Aug. 2015 — Aug. 2017
M.S. in Electrical and Computer Engineering
Overall GPA: 4.0/4.0

Tsinghua University Sept. 2011 — Jul. 2015
B.E. in Automation (with honor) & **Dual Degree** in Economics

RESEARCH INTERESTS

My research interests lie in reinforcement learning and optimization in multi-agent/networked systems, game theory, and robust control; with applications in cyber-physical systems including smart grid and electricity markets, transportation networks, and robotics.

RESEARCH EXPERIENCES

Learning for robust control Sept. 2018 — Present
Department of ECE, UIUC *Advisor: Prof. Tamer Başar*

· Investigate the landscape of robust control problems, e.g., risk-sensitive control and linear quadratic games, from an optimization perspective
· Develop and analyze reinforcement learning algorithms for robust control

Global convergence of policy gradient methods June 2018 — Sept. 2018
Department of ECE, UIUC *Advisor: Prof. Tamer Başar*

· Investigate the global convergence property of policy gradient algorithms
· Identify a condition for reward-reshaping that benefits the global convergence

Multiagent reinforcement learning for networked agents Sept. 2017 — Present
Department of ECE, UIUC *Advisor: Prof. Tamer Başar*

· Develop and analyze distributed reinforcement learning algorithms for networked systems

On the value of communication links for distribution network operation: A game theoretic perspective Aug. 2016 — Aug. 2017
Department of ECE, UIUC *Advisor: Prof. Hao Zhu*

· Analyze and develop distributed algorithms for voltage-VAR control under limited communication links using game theoretic approaches.
· Aim to quantify the fundamental value of communication links for infrastructure deployment.

Dynamic electric vehicles travel management in coupled power and transportation networks April 2016 — April 2017

Department of ECE & CEE, UIUC *Advisor: Prof. Hao Zhu*

· Electricity pricing for electric vehicles that benefits both power and transportation networks operation.

· Improve the modeling of the coupled networks by incorporating time-varying/dynamic travel demand.

On the performance of map-aware cooperative localization Oct. 2014 — May 2015

Department of EECS, MIT *Advisor: Prof. Moe Z. Win & Prof. Yuan Shen*

· Characterize the fundamental limits of localization accuracy by the information-theoretic bounds, i.e., Ziv-Zakai and Weiss-Weinstein bounds, for map-aware cooperative localization.

PUBLICATIONS

Book Chapters

· **Kaiqing Zhang**, Zhuoran Yang, and Tamer Başar, "Multi-Agent Reinforcement Learning: A Selective Overview of Theories and Algorithms", *Studies in Systems, Decision and Control Handbook on Reinforcement Learning and Control, Springer.*

Journals and Preprints

· **Kaiqing Zhang**, Bin Hu, and Tamer Başar, "Policy optimization for $\mathcal{H}_2$ linear control with $\mathcal{H}_\infty$ robustness guarantee: Implicit regularization and global convergence", *arXiv:1910.09496.*

· **Kaiqing Zhang**, Alec Koppel, Hao Zhu, and Tamer Başar, "Global convergence of policy gradient methods to (almost) locally optimal policies ", *SIAM Journal on Control and Optim., under review.*

· **Kaiqing Zhang**, Zhuoran Yang, Han Liu, Tong Zhang, and Tamer Başar, "Finite-sample analysis for decentralized batch multi-agent reinforcement learning with networked agents", *IEEE Trans. on Automatic Control (TAC), under review.*

· Tianyi Chen, **Kaiqing Zhang**, Georgios B. Giannakis, and Tamer Başar, "Communication-efficient distributed reinforcement learning", *IEEE Trans. on Automatic Control (TAC), under review.*

· **Kaiqing Zhang**†, Alec Koppel†, Hao Zhu, and Tamer Başar, "Projected stochastic primal-dual method for constrained online learning with kernels" (The authors † contribute equally), *IEEE Trans. on Signal Process. (TSP), vol. 67 , no. 10 , pp. 2528-2542, May, 2019.*

· **Kaiqing Zhang**, Yang Liu, Ji Liu, Mingyan Liu, and Tamer Başar, "Distributed learning of average belief over networks using sequential observations," *Automatica, 2019.*

· **Kaiqing Zhang**, Liqun Lu, Chao Lei, Hao Zhu, and Yanfeng Ouyang, "Dynamic operations and pricing of electric unmanned aerial vehicle systems and power networks," *Journal of Transportation Research Part C: Emerging Technologies*, vol. 92, pp. 472-485, July 2018.

· **Kaiqing Zhang**, Wei Shi, Hao Zhu, Emiliano Dall'Anese, and Tamer Başar, "Dynamic power distribution system management with a locally connected communication network," *IEEE Journal of Selected Topics in Signal Process. (JSTSP)*, vol. 12, no. 4, pp. 673-687, May 2018.

· Hanchen Xu, **Kaiqing Zhang**, and Junbo Zhang, "Optimal joint bidding and pricing of profit-seeking load serving entity," *IEEE Trans. on Power Systems (TPS)*, vol. 33, no. 5, pp. 5427-5436, March 2018.

· Yingchen Zhang, Rui Yang, **Kaiqing Zhang**, Huaiguang Jiang, and Jun Jason Zhang, "Consumption behavior analytics-aided energy forecasting and dispatch," *IEEE Intelligent Systems*, vol. 32, no. 4, pp. 59-63, Aug. 2017.

· **Kaiqing Zhang**, Siming Guo, and Hao Zhu, "Dependency analysis and improved parameter estimation for complex dynamic load modeling," *IEEE Trans. on Power Systems (TPS)*, vol. 32, no. 4, pp. 3287-3297, Nov. 2016.

· Feifei Gao and **Kaiqing Zhang**, "Enhanced multi-parameter cognitive architecture for future wireless communications," *IEEE Commun. Magazine*, vol. 53, no. 7, pp. 86-92, Jul. 2015.

Conferences

- **Kaiqing Zhang**, Zhuoran Yang, Han Liu, Tong Zhang, and Tamer Başar, "Finite-sample analyses for decentralized cooperative multi-agent reinforcement learning from batch data," *IFAC World Congress, 2020 (under review).*
- Muhammad Aneeq uz Zaman, **Kaiqing Zhang**, Erik Miehling, and Tamer Başar, "Approximate equilibrium computation for discrete-time linear-quadratic mean-field games," *IEEE American Control Conf. (ACC), 2020 (under review).*
- **Kaiqing Zhang**, Zhuoran Yang, and Tamer Başar, "Policy optimization provably converges to Nash equilibria in zero-sum linear quadratic games", *Neural Info. Process. Systems (NeurIPS) 2019.*
- Xiangyuan Zhang, **Kaiqing Zhang**, Erik Miehling, and Tamer Başar, "Non-Cooperative Inverse Reinforcement Learning", *Neural Info. Process. Systems (NeurIPS) 2019.*
- **Kaiqing Zhang**, Alec Koppel, Hao Zhu, and Tamer Başar, "Convergence and iteration complexity of policy gradient method for infinite-horizon reinforcement learning", *IEEE Conf. on Decision and Control (CDC), 2019.*
- Yixuan Lin, **Kaiqing Zhang**, Zhuoran Yang, Zhaoran Wang, Tamer Basąr, Romeil Sandhu, and Ji Liu, "A communication-efficient multi-agent actor-critic algorithm for distributed reinforcement learning", *IEEE Conf. on Decision and Control (CDC), 2019.*
- **Kaiqing Zhang**, Alec Koppel, Hao Zhu, and Tamer Başcar. "Policy search in infinite-horizon discounted reinforcement learning: Advances through connections to non-convex optimization," *IEEE Annual Conf. on Info. Sci. and Syst. (CISS), 2019.*
- **Kaiqing Zhang**, Erik Miehling, and Tamer Başar, "Online planning for decentralized stochastic control with partial history sharing," *IEEE American Control Conf. (ACC), 2019.*
- **Kaiqing Zhang**, Hao Zhu, Tamer Başar, and Alec Koppel, "Projected stochastic primal-dual method for constrained online learning with kernels", *IEEE Conf. on Decision and Control (CDC), 2018.*
- **Kaiqing Zhang**, Zhuoran Yang, and Tamer Başar, "Networked multi-agent reinforcement learning in continuous spaces", *IEEE Conf. on Decision and Control (CDC), 2018.*
- Zhuoran Yang, **Kaiqing Zhang**, Mingyi Hong, and Tamer Başar, "A finite sample analysis of the actor-critic algorithm", *IEEE Conf. on Decision and Control (CDC), 2018.*
- **Kaiqing Zhang**, Zhuoran Yang, Han Liu, Tong Zhang, and Tamer Başar, "Fully decentralized multi-agent reinforcement learning with networked agents", *Intl. Conf. on Machine Learning (ICML), 2018.*
- **Kaiqing Zhang**, Wei Shi, Hao Zhu, and Tamer Başar, "Distributed equilibrium-learning for power network voltage control with a locally connected communication network," *IEEE American Control Conf. (ACC), 2018.*
- **Kaiqing Zhang**, Zhuoran Yang, and Zhaoran Wang, "Nonlinear structured signal estimation in high dimensions via iterative hard thresholding," *Intl. Conf. on Artificial Intelligence and Statistics (AISTATS), 2018.*
- **Kaiqing Zhang** and Hao Zhu, "A game theoretic approach for communication-free distribution system management," *IEEE Global Conf. on Signal and Info. Process. (GlobalSIP), 2017.*
- **Kaiqing Zhang**, Siming Guo, and Hao Zhu, "Parameter sensitivity and dependency analysis for the WECC dynamic composite load model," *Hawaii Intl. Conf. System Sciences (HICSS)*, 2017.
- **Kaiqing Zhang**, Yuan Shen, and Moe Z. Win, "On the performance of map-aware cooperative localization," *IEEE Intl. Conf. on Commun. (ICC)*, 2016.
- **Kaiqing Zhang**, Hong Hu, Wenhan Dai, Yuan Shen, and Moe Z. Win, "An area state-aided indoor localization algorithm and its implementation," *IEEE Intl. Conf. on Commun. (ICC)*, 2015.
- Zhao Zhang, **Kaiqing Zhang**, Feifei Gao, and Shun Zhang, "Spectrum prediction and channel selection for sensing-based spectrum sharing scheme using online learning techniques," *IEEE Intl. Symp. on Personal, Indoor and Mobile Radio Commun. (PIMRC)*, 2015.
- **Kaiqing Zhang**, Jiachen Li, and Feifei Gao, "Machine learning techniques for spectrum sensing when primary user has multiple transmit powers," *IEEE Intl. Conf. on Commun. Systems (ICCS)*, 2014.

WORKING EXPERIENCES

Research Scientist Intern	Nation. Renew. Energy Lab. (NREL), CO	Jun. 2016 — Sept. 2016
Visiting Fellow	Army Research Lab. (ARL), Adelphi, MD	Jun. 2018 — Aug. 2018
Research Scientist Intern	Amazon AWS AI Labs, Seattle, WA	May 2019 — Aug. 2019

AWARDS & HONORS

- NeurIPS Travel Award 2019
- CDC Student Travel Award (Declined) 2019
- Mavis Future Faculty Fellows (MF3), UIUC 2019
- Hong, McCully, and Allen Fellowship (**$12000**), UIUC 2018 & 2019
- ICML Travel Award 2018
- James M. Henderson Fellowship, University of Illinois at Urbana-Champaign 2016
- **Best poster award** of the PSERC IAB meeting 2015
- Beijing Outstanding Undergraduate Thesis 2015
- National Scholarship (**top 3%**), Tsinghua University 2014
- **Meritorious Winner** 2014 Mathematical Contest in Modeling 2014
- **First Prize** in 34th Challenge Cup of Tsinghua University 2014
- **Third place** in competition of Adult-Size Group in RoboCup 2013
- Comprehensive First-Class Scholarship of Tsinghua University (**top 5%**) 2012 & 2013

PROFESSIONAL SERVICES & ACTIVITIES

- Reviewer for *ICML*, *Mathematical Programming, IEEE Trans. Automatic Control (TAC), Automatica, IEEE Journal of Selected Topics in Signal Processing (JSTSP), IEEE Trans. Smart Grid (TSG), IEEE Trans. Power Systems (TPS), IEEE Communications Letters (CL), IEEE American Control Conf. (ACC), IEEE Control and Decision Conf. (CDC), IEEE Intl. Conf. on Communications (ICC).*
- President of Tsinghua University Alumni Association (THU-AA) in UIUC Sept. 2019 — Present
- Committee of the 8th *IEEE Power and Energy Conf. at Illinois (PECI)* April 2016 — Feb. 2017
- Vice-President of the Student Union of the Dept. of Automation Aug. 2013 — Aug. 2014