Dongsheng Ding

CONTACT INFORMATION

Department of Electrical and Computer Engineering — Office: EEB 320
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EDUCATION

PhD Candidate, Electrical Engineering, GPA: 4.0/4.0 — Summer 2022 (expected)
University of Southern California
Advisor: Professor Mihailo R. Jovanović

MS in Electrical Engineering, GPA: 3.9/4.0 — Summer 2017
University of Minnesota, Twin Cities

ME in Control Theory & Engineering, GPA: 3.7/4.0 — Spring 2015
BE in Automation, GPA: 3.8/4.0 — Summer 2011
Zhejiang University, Hangzhou, China

RESEARCH INTERESTS

My research interests lie in the interface of Optimization, Control Theory, and Reinforcement Learning. My current research focuses on the analysis and design of control and decision-making methods for dealing with real-world environments, e.g., safety/risk constraints, multi-agent interactions, and unknown/time-varying dynamics. Applications include autonomous robotics, personalized medicine, smart grid, and intelligent transportation systems.

PREPRINTS

1. D. Ding, C.-Y. Wei, K. Zhang, and M. R. Jovanović. "Independent policy gradient for large-scale Markov potential games: sharper rates, function approximation, and game-agnostic convergence ," submitted.
2. D. Ding, X. Wei, Z. Yang, Z. Wang, and M. R. Jovanović. "Sample efficient genearalized Lagrangian policy optimization for safe multi-agent reinforcement learning," submitted.

REFEREED PUBLICATIONS

Journals

1. D. Ding, K. Zhang, J. Duan, T. Başar, and M. R. Jovanović. "Convergence and optimality of natural policy gradient primal-dual methods for constrained MDPs," *J. Mach. Learn. Res.*, 2022. (under revision)
2. D. Ding, X. Wei, Z. Yang, Z. Wang, and M. R. Jovanović. "Fast multi-agent temporal-difference learning via homotopy stochastic primal-dual optimization," *IEEE Trans. Autom. Control*; also arXiv:1908.02805, 2020. (under review)
3. Q. Wang, J. Zhang, D. Ding, and D. Qi, "Adaptive Mittag-Leffler stabilization of a class of fractional order uncertain nonlinear systems," *Asian J. Control*,

18(6) 2343–2351, 2016.

4. D. Ding, D. Qi, and Q. Wang, "Asymptotic pseudo-state stabilization of uncertain fractional-order nonlinear systems with additive disturbance," *Nonlinear Dyn.*, 81(1) 667–677, 2015.
5. Q. Wang, D. Ding, and D. Qi, "Mittag-Leffler synchronization of uncertain fractional order chaotic systems," *Chinese Physics B*, 24(6), 2015.
6. D. Ding, D. Qi, and Q. Wang, "Nonlinear Mittag-Leffler stabilization of commensurate fractional-order nonlinear systems," *IET Control Theory Appl.*, 9(5) 681–690, 2014.
7. D. Ding, D. Qi, X. Luo, J. Chen, X. Wang, and P. Du, "Convergence analysis and performance of an extended central force optimization algorithm," *Appl. Math. Comput.*, 219(4), 2246–2259, 2012.
8. D. Ding, X. Luo, J. Chen, X. Wang, P. Du, and Y. Guo, "A convergence proof and parameter analysis of central force optimization algorithm," *J. Convergence Inf. Technol.*, 6(10), 16–23, 2011.

Conferences

1. D. Ding, K. Zhang, T. Basar and M. R. Jovanović, "Convergence and optimality of policy gradient primal-dual method for constrained Markov decision processes," in *Proceedings of the 2022 American Control Conference*, Atlanta, Georgia, 2022. (to appear)
2. D. Ding, X. Wei, H. Yu, and M. R. Jovanović. "Byzantine-resilient distributed learning under constraints," in *Proceedings of the 2021 American Control Conference*, New Orleans, Louisiana, 2021.
3. D. Ding, J. Yuan, and M. R. Jovanović. "Discounted online Newton method for time-varying time series prediction," in *Proceedings of the 2021 American Control Conference*, New Orleans, Louisiana, 2021.
4. D. Ding, X. Wei, Z. Yang, Z. Wang, and M. R. Jovanović. "Provably efficient safe exploration via primal-dual policy optimization," in *Proceedings of The 24th International Conference on Artificial Intelligence and Statistics*, Virtual, 2021. (acceptance rate 30%, 48/455 orals)
5. D. Ding, K. Zhang, T. Başar, and M. R. Jovanović. "Natural policy gradient primal-dual method for constrained Markov decision processes," in *Proceedings of the Advances in Neural Information Processing Systems*, Virtual, 2020. (acceptance rate 20%)
6. D. Ding and M. R. Jovanović. "Global exponential stability of primal-dual gradient flow dynamics based on the proximal augmented Lagrangian," in *Proceedings of the 59th IEEE Conference on Decision and Control*, Virtual, 2020.
7. D. Ding, X. Wei, Z. Yang, Z. Wang, and M. R. Jovanović. "Fast multi-agent temporal-difference learning via homotopy stochastic primal-dual method," in

the Optimization Foundations for Reinforcement Learning Workshop at NeurIPS, Vancouver, Canada, 2019.

8. D. Ding, X. Wei, and M. R. Jovanović. "Distributed robust statistical learning: Byzantine mirror descent," in *Proceedings of the 58th IEEE Conference on Decision and Control*, Nice, France, 2019.
9. D. Ding and M. R. Jovanović. "Global exponential stability of primal-dual gradient flow dynamics based on the proximal augmented Lagrangian," in *Proceedings of the 2019 American Control Conference*, Philadelphia, Pennsylvania, 2019.
10. D. Ding, B. Hu, N. K. Dhingra, and M. R. Jovanović. "An exponentially convergent primal-dual algorithm for nonsmooth composite minimization," in *Proceedings of the 57th IEEE Conference on Decision and Control*, Miami Beach, Florida, 2018.
11. D. Ding and M. R. Jovanović. "A primal-dual Laplacian gradient flow dynamics for distributed resource allocation problems," in *Proceedings of the 2018 American Control Conference*, Milwaukee, Wisconsin, 2018.
12. D. Ding, D. Qi, and Q. Wang, "Adaptive Mittag-Leffler stabilization of commensurate fractional-order nonlinear systems," in *Proceedings of the 53rd IEEE Conference on Decision and Control*, Los Angeles, California, 2014.
13. D. Ding, G. Zhang, D. Qi, and H. Zhang, "Strategy analysis of an evolutionary spectrum sensing game," in *the Intelligent Computing and Applications (LSMS & ICSEE)*, Shanghai, China, 2014. (Nominate Paper Award)
14. D. Ding, D. Qi, and Q. Wang, "Alternative LMI characterizations for fractional-order linear systems," in *Proceedings of the 33rd Chinese Control Conference*, Nanjing, China, 2014.
15. D. Ding, D. Qi, and Q. Wang, "Fractional-order integral state space modeling and quasi state analysis via block operational matrix scheme," in *Proceedings of the 26th Chinese Control and Decision Conference*, Changsha, China, 2014.

TALKS & POSTERS

1. Poster of "Provably efficient safe exploration via primal-dual policy optimization" in *the 11th Annual Research Festival*, ECE, USC, 2021.
2. Talk of "Provable constrained policy optimization for reinforcement learning" in *the 38th Southern California Control Workshop*, University of California, Irvine, California, Virtual, 2021.
3. Talk & Poster of "Provably efficient safe exploration via primal-dual policy optimization" in *the 24th International Conference on Artificial Intelligence and Statistics*, Virtual, 2021. (48/455 orals)
4. Talk & Poster of "Natural Policy Gradient Primal-Dual Method for Constrained Markov Decision Processes" in *the 34th Conference on Neural Information Processing Systems*, Virtual, 2020.

5. Talk of "Global exponential stability of primal-dual gradient flow dynamics based on the proximal augmented Lagrangian" in *the 59th IEEE Conference on Decision and Control*, Virtual, 2020.
6. Poster of "Fast multi-agent temporal-difference learning via homotopy stochastic primal-dual method," in *the Optimization Foundations for Reinforcement Learning Workshop at NeurIPS*, Vancouver, Canada, 2019; *the Southern California Machine Learning Symposium*, UCSD, 2020.
7. Poster of "Distributed robust statistical learning: Byzantine mirror descent" in *the 10th Annual Research Festival*, ECE, USC, 2019.
8. Talk of "Exponential stability of primal-dual gradient flow dynamics based on proximal augmented Lagrangian," in *the 2019 American Control Conference*, Philadelphia, Pennsylvania, 2019.
9. Talk of "Nonsmooth composite minimization: an exponentially convergent primal-dual algorithm," in *the 57th IEEE Conference on Decision and Control*, Miami Beach, Florida, 2018.
10. Poster of "An exponentially stable primal-dual algorithm for nonsmooth optimization" in *the 9th Annual Research Festival*, ECE, USC, 2018.
11. Talk of "A primal-dual Laplacian gradient flow dynamics for distributed resource allocation problems," in *the 2018 American Control Conference*, Milwaukee, Wisconsin, 2018.
12. Talk of "A primal-dual algorithm for distributed resource allocation" in *the 34th Southern California Control Workshop*, University of California, Riverside, California, 2018.
13. Talk of "Adaptive Mittag-Leffler stabilization of commensurate fractional-order nonlinear systems" in *the 53rd IEEE Conference on Decision and Control*, Los Angeles, California, 2014.
14. Talk of "Alternative LMI characterizations for fractional-order linear systems" in *the 33rd Chinese Control Conference*, Nanjing, China, 2014.
15. Talk of "Fractional-order integral state space modeling" in *the 26th Chinese Control and Decision Conference*, Changsha, China, 2014.

HONORS & AWARDS

Expert Reviewers, International Conference on Machine Learning	5/2021
Travel Award, Conference on Neural Information Processing Systems	10/2020
Top Reviewers, International Conference on Machine Learning	5/2020
Travel Award, IEEE Conference on Decision and Control	8/2020
Travel Award, American Control Conference	7/2019, 6/2018
MHI PhD Scholar Finalist, ECE, University of Southern California	9/2018 & 2021
ECE Department Fellowship, University of Minnesota	8/2015
Honor for Outstanding Graduate Student, Zhejiang University	4/2015
Nominate Paper Award, LSMS & ICSEE, 2014, Shanghai	2014
Bosch Scholarship, Bosch in China	2013

The First-Class of Graduate Scholarship, Zhejiang University 2012–2015
National Scholarship, Ministry of Education of P.R. China 2011
Wei Shaoxiang Engineering Talent, Wei Shaoxiang Foundation, HongKong 2010
The Second-Class of Physics and Technology Innovation Contest, Zhejiang Physical Society, Zhejiang, China 2009
The First-Class of Advanced Mathematics Contest, Zhejiang Mathematical Society, Zhejiang, China 2008

ACADEMIC & TEACHING ACTIVITIES

Referee

IEEE Transactions on Control of Network Systems
IEEE Transactions on Automatic Control
IEEE Robotics and Automation Letters
IEEE Control Systems Letters
Systems & Control Letters
Optimization Letters
Automatica
IEEE Access
IET Control Theory & Applications
International Journal of Robust and Nonlinear Control
Frontiers of Information Technology & Electronic Engineering
International Journal of Systems Science
The Journal of the Franklin Institute
Nonlinear Dynamics
Journal of Applied Mathematics and Computing
Journal of Machine Learning Research
IEEE Transactions on Pattern Analysis and Machine Intelligence
IEEE Conference on Decision and Control, 2018, 2019, 2020, 2021
Conference on Neural Information Processing Systems, 2020, 2021
International Conference on Learning Representations, 2021, 2022
International Conference on Artificial Intelligence and Statistics, 2021
International Conference on Machine Learning, 2020, 2021, 2022
American Control Conference, 2018, 2019, 2020, 2021, 2022
IFAC World Congress, 2020
Chinese Control Conference, 2014
Chinese Control and Decision Conference, 2014

Volunteer for Conference

38th International Conference on Machine Learning, Virtual, 2021
24th International Conference on Artificial Intelligence and Statistics, Virtual, 2021
Conference on Neural Information Processing Systems, Virtual, 2021

Co-chair of Nonlinear System and Control Section

26th Chinese Control and Decision Conference, Changsha, China, 2014

Teaching Assistant, University of Minnesota Twin Cities
EE 4231 Automatic Control Systems, Fall, 2016
EE 3015 Statistical Methods in Electrical and Computer Engineering, Spring, 2017
EE 8231 Optimization Theory, Spring, 2017

Mentor for Graduate Students, University of Southern California
Viterbi Graduate Mentorship Program, Fall 2018 – Now

SKILLS

Matlab, C/C++, Python, LaTeX, SQL

MEMBERSHIPS

The Institute of Electrical and Electronics Engineers (IEEE)
IEEE Control Systems Society Membership
Stanford Encyclopedia of Philosophy

GRADUATE COURSE HIGHLIGHTS

Control Systems: EE 5231 Linear System and Optimal Control, EE 8215 Nonlinear Systems, AEM 8421 Robust Multi-Variable Control Systems, AEM 8423 Convex Optimization Methods in Control; **Optimization and Computation:** EE 5239 Introduction to Nonlinear Optimization, EE 8231 Optimization Theory, ISE 633 Large-Scale Optimization for Machine Learning, CSCI 5304 Computational Aspects of Matrix Theory, CSCI 8314 Sparse Matrix Computations; **Probability and Machine Learning:** MATH 507A/B Theory of Probability, EE 556 Stochastic Systems & Reinforcement Learning, CSCI 5525 Machine Learning, EE 546 Mathematics of High-Dimensional Data, DSO 699 Statistical Learning Theory, CSCI 699 Theoretical Machine Learning, EE 5581 Information Theory and Coding.