ERMIN WEI

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EMPLOYMENT

Northwestern University, Evanston, IL — Sep 2014-Present
Assistant Professor
Department of Electrical and Computer Engineering
Department of Industrial Engineering and Management Sciences
Robert R. McCormick School of Engineering

Philips Research North America, Briarcliff Manor, NY — May 2012 – Aug 2012
Research Intern

Microsoft Corp., Redmond, WA — Jun 2006 – Aug 2006
Software Develop Engineer Intern

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA
Ph.D. in Electrical Engineering and Computer Science — Sep 2014
Ph.D. thesis: Distributed Optimization and Market Analysis of Networked Systems
M.S. in Electrical Engineering and Computer Science — Jun 2010
Masters thesis: Distributed Newton-type Algorithms for Network Resource Allocation
Advisor: Prof. Asu Ozdaglar

University of Maryland, College Park, MD
B.S. Triple Degree: Computer Engineering, Finance and Mathematics, Minor in German — May 2008

RESEARCH INTERESTS

Large scale distributed optimization algorithms and theory with emphasis on nonlinear convex and non-convex optimization, network optimization and their applications including machine learning. Smart grid and energy networks with focus of market analysis and mechanism design.

SELECTED AWARDS AND HONORS

- Department of Energy ARPA-E Grid Optimization Competition, 2nd place (2019)
- Graduate Women of Excellence Award (2013)
- Ernst A. Guillemen Thesis Award, 2nd place (2010)
- Alpha Lambda Delta National Academic Honor Society Betty Jo Budson Fellowship (2009)
- Undergraduate Student Researcher of the Year (2007-2008)
- ISR Outstanding System Engineering Undergraduate Student Award (2008)
- International Engineering Consortium's (IEC) William L. Everitt Award of Excellence (2008)
- Department of Mathematics Abramowitz Award (2008)

TEACHING

- Introduction to Smart Grid Systems (new ECE course) - Fall 2014, Spring 2018, Fall 2023
- Distributed Optimization (new ECE course) - Winter 2015, Winter 2017, Winter 2018, Winter 2020, Winter 2022

- Optimization and Learning in Stochastic Dynamic Environments (new IEMS course) - Fall 2022
- Game Theory and Networked Systems (new ECE course, jointly developed with Randy Berry) - Spring 2017, Fall 2018, Spring 2022
- Probabilistic Systems and Random Signals - Annually
- Undergraduate Independent Studies - 2014, 2015, 2021, 2022
- Graduate Independent Studies - 2018, 2021, 2022

PATENT

- S. R. Bagheri, S. Rangavajhala, E. Shen and E. Wei. Energy Retrofit Risk Management System. Philips Research North America.

JOURNAL PUBLICATIONS

J1 I. Aravena, D. Molzahn, S. Zhang, C. Petra, F. Curtis, S. Tu, A. Wächter, E. Wei, E. Wong, A. Gholami and K. Sun. "Recent Developments in Security-Constrained AC Optimal Power Flow: Overview of Challenge 1 in the ARPA-E Grid Optimization Competition", Invited, under review Operations Research, arXiv preprint arXiv:2206.07843, 2022

J2 C. Iakovidou and E. Wei. "S-NEAR-DGD: A flexible distributed stochastic gradient method for inexact communication", IEEE Transactions on Automatic Control, 2022

J3 S. Lan, Z. Wang, E. Wei, A. K. Roy-Chowdhury, and Q. Zhu. "Collaborative Multi-Agent Video Fast-Forwarding." submitted to IEEE Transactions on Multimedia, 2022

J4 F. Curtis, D. Molzahn, S. Tu, A. Wächter, E. Wei and E. Wong. "A Decomposition Algorithm for Large-Scale Security-Constrained AC Optimal Power Flow", Invited, second round review Operations Research, arXiv preprint arXiv:2110.01737, 2021

J5 X. Niu and E. Wei. "FedHybrid: A hybrid primal-dual algorithm framework for federated optimization", submitted to IEEE Transactions on Signal Processing, arxiv preprint arXiv:2106.01279, 2021

J6 F. Mansoori and E. Wei. "FlexPD: A Flexible Framework of First-Order Primal-Dual Algorithms for Distributed Optimization", IEEE Transactions on Signal Processing, 2021

J7 A. Berahas, R. Bollapragada, and E. Wei. "On the convergence of nested decentralized gradient methods with multiple consensus and gradient steps", IEEE Transactions on Signal Processing, 2021

J8 M. Zhang, E. Wei, and R. Berry. "Faithful Edge Federated Learning: Scalability and Privacy", IEEE Journal on Selected Areas in Communications, 2021

J9 M. Zhang, A. Arafa, E. Wei, and R. Berry. "Optimal and quantized mechanism design for fresh data acquisition", IEEE Journal on Selected Areas in Communications 39, 2021

J10 D. Xiang, E. Wei, "A general sensitivity analysis approach for demand response optimizations", IEEE Transactions on Network Science and Engineering, 2020

J11 S. Tu, A. Wächter and E. Wei, "A Two-Stage Decomposition Approach for AC Optimal Power Flow," in IEEE Transactions on Power Systems, 2020

J12 H. Yu, E. Wei, and R. Berry, "Monetizing mobile data via data rewards." IEEE Journal on Selected Areas in Communications 38.4, 2020

J13 H. Yu, E. Wei, and R. Berry, "Analyzing Location-Based Advertising for Vehicle Service Providers Using Effective Resistances," Proceedings of the ACM on Measurement and Analysis of Computing Systems, vol. 3, no. 1, 2019

J14 B. Badia, R. Berry and E. Wei, "Investment in EV charging spots for Parking", IEEE Transactions on Network Science and Engineering, 2019

J15 F. Mansoori, E. Wei, "A Fast Distributed Asynchronous Newton-Based Optimization Algorithm", IEEE Transactions on Automatic Control, 2019

J16 B. Zhuang, Do. Guo, E. Wei, and M. Honig, "Large-Scale Spectrum Allocation for Cellular Networks via Sparse Optimization", IEEE Transactions on Signal Processing, 2018

J17 A. Berahas, R. Bollapragada, N. Keskar and E. Wei, "Balancing Communication and Computation in Distributed Optimization", IEEE Transactions on Automatic Control, 2018

J18 B. Zhuang, D. Guo, E. Wei and M. Honig, "Scalable Spectrum Allocation and User Association in Networks with Many Small Cells", IEEE Transactions on Communications, 2017

J19 E. Wei, A. Ozdaglar and A. Jadbabaie, "A Distributed Newton Method for Network Utility Maximization, I: Algorithm", IEEE Transactions on Automatic Control, vol. 58, no. 9, pp. 2162-2175, 2013

J20 E. Wei, A. Ozdaglar and A. Jadbabaie, "A Distributed Newton Method for Network Utility Maximization, II: Convergence", IEEE Transactions on Automatic Control, vol. 58, no. 9, pp. 2176-2188, 2013

J21 E. Wei, E. Justh and P. S. Krishnaprasad, "Pursuit and an Evolutionary Game", Proc. R. Soc, A, vol. 465, no. 2105:1539-1559, 2009

CONFERENCE PUBLICATIONS

C1 Z. Sun and E. Wei. "A Communication-efficient Algorithm with Linear Convergence for Federated Minimax Learning", NeurIPS 2022

C2 X. Niu and E. Wei. "DISH: A Distributed Hybrid Primal-Dual Optimization Framework to Utilize System Heterogeneity", Invited, Proceedings of IEEE Conference on Decision and Control (CDC), 2022

C3 M. Zhang, E. Wei, R. Berry and J. Huang. "Age-Dependent Differential Privacy", Abstract Proceedings of the 2022 ACM SIGMETRICS/IFIP PERFORMANCE Joint International Conference on Measurement and Modeling of Computer Systems, 2022

C4 L. Yi and E. Wei. "The Effects of Varying Charging Rates on Optimal Charging Station Choices for Electric Vehicles", Proceedings of Annual Allerton Conference on Communication, Control, and Computing, 2022

C5 C. Iakovidou and E. Wei. "On the convergence of near-dgd for nonconvex optimization with second order guarantees," 2021 60th IEEE Conference on Decision and Control (CDC). IEEE, 2021

C6 M. Zhang, A. Arafa, E. Wei, and R. Berry. "Optimal mechanism design for fresh data acquisition", IEEE International Symposium on Information Theory, 2021

C7 S. Lan, Z. Wang, A. K. Roy-Chowdhury, E. Wei, and Q. Zhu. "Distributed Multi-agent Video Fast-forwarding", ACM Multimedia Conference, 2020

C8 F. Mansoori and E. Wei, " A General Framework of Exact Primal-Dual First Order Algorithms for Distributed Optimization", Invited, Proceedings of IEEE Conference on Decision and Control (CDC), 2019

C9 A. Berahas, C. Iakovidou and E. Wei, "Nested Distributed Gradient Methods with Adaptive Quantized Communication", Proceedings of IEEE Conference on Decision and Control (CDC), 2019

C10 B. Badia, R. Berry and E. Wei, "Renewable generation investment with downstream competition", Proceedings of Annual Allerton Conference on Communication, Control, and Computing, 2019

C11 C. Iakovidou and E. Wei, "Nested Distributed Gradient Methods with Stochastic Computation Errors", Proceedings of Annual Allerton Conference on Communication, Control, and Computing, 2019

C12 H. Yu, E. Wei, and R. Berry, "Analyzing Location-Based Advertising for Vehicle Service Providers Using Effective Resistances," Proceedings of the ACM SIGMETRICS International Conference on Measurement and Modeling of Computer Systems, 2019

C13 H. Yu, R. Randy and E. Wei, "A Business Model Analysis of Mobile Data Rewards", Proceedings of INFOCOM, 2019

C14 H. Yu, E. Wei and R. Berry, "Watch Ads, Earn Data: Economics of Mobile Data Rewards", Proceedings of NetEcon, 2018

C15 B. Zhuang, D. Guo, E. Wei and M. Honig, "Scalable Spectrum Allocation for Large Networks Based on Sparse Optimization", Proceedings of IEEE International Symposium on Information Theory, 2017

C16 D. Xiang, E. Wei, "Improving social welfare by demand response General Framework and Quantitative Characterization", Invited, Proceedings IEEE GlobalSIP, 2017

C17 F. Mansoori and E. Wei, "Superlinearly Convergent Asynchronous Distributed Network Newton Method", Invited, Proceedings of IEEE Conference on Decision and Control (CDC), 2017

C18 E. Wei, "Parallel Multi-splitting Proximal Method for Star Networks", Invited, Proceedings of American Control Conference, 2017

C19 C. Liu, Y. Xiao, E. Wei and R. Berry, "Competition and Investment in On-Demand Networking Technology", Proceedings of IEEE/IFIP WONS, 13th Wireless On-demand Network systems and Services Conference, 2017

C20 Y. Xiao, C. Bandi and E. Wei, "Supply Function Equilibrium in Power Markets: Mesh Networks", Proceedings of IEEE GlobalSIP, 2016

C21 Y. Xiao, C. Bandi and E. Wei, "Robust Supply Function Bidding in Electricity Markets with Renewables", Invited, Proceedings of 54th Annual Allerton Conference on Communication, Control, and Computing, 2016

C22 E. Wei, C. Bandi, "Fairness Considerations in Network Flow Problems", Invited, Proceedings of IEEE Conference on Decision and Control (CDC), 2015

C23 Y. Xiao, C. Bandi, E. Wei, "Efficiency of Supply Function Equilibrium in Networked Markets", Invited, Allerton Conference on Communication, Control and Computing, 2015

C24 C. Liu, Y. Xiao, E. Wei, R. Berry, "Investment and Competition with Positive Externalities in Open Networks", Invited, Allerton Conference on Communication, Control and Computing, 2015

C25 Y. Xiao, C. Bandi, E. Wei, "Network Effects on Efficiency of Supply Function Equilibrium in Electricity Markets", Invited, Asilomar Conference on Signals, Systems and Computers, 2015

C26 E. Wei, S. R. Bagheri, S. Rangavajhala, E. Shen, "A Comprehensive Risk Management System On Building Energy Retrofit", Proceedings of SRII (Service Research and Innovation Institute), 2014

C27 E. Wei and A. Ozdaglar, "On the O(1/k) Convergence of Asynchronous Distributed Alternating Direction Method of Multipliers", Invited, Proceedings of IEEE Global Conference on Signal and Information Processing, 2013

C28 E. Wei and A. Ozdaglar, "Distributed Alternating Direction Method of Multipliers", Invited, Proceedings of Conference on Decision and Control (CDC), 2012

C29 E. Wei, A. Ozdaglar, A. Eryilmaz and A. Jadbabaie, "A Distributed Newton Method for Dynamic Network Utility Maximization with Delivery Contracts", Invited, Proceedings of Conference on Information Sciences and Systems (CISS), 2012

C30 E. Wei, M. Zargham, A. Ozdaglar and A. Jadbabaie, "On Dual Convergence of the Distributed Newton Method for Network Utility Maximization", Invited, Proceedings of Decision and Control and European Control Conference (CDC-ECC), 2011

C31 E. Wei and A. Ozdaglar and A. Jadbabaie, "A Distributed Newton Method for Network Utility Maximization", Invited, Proceedings of Conference on Decision and Control (CDC), 2010

FUNDINGS

F1 "NRI: INT: Robotic Shepherding for Flow Control in Uncertain Dynamic Environments", National Science Foundation (NSF), $1,429,410, PI, with R. Freeman, K. Lynch and M. Rubenstein, 9/1/2020-8/31/2024

F2 "Selection of Systems of Arms in Multi-Armed Bandits", The Home Depot, $35,304, PI, 06/01/2022-06/02/2023

F3 "Collaborative Research: SWIFT: LARGE: Dynamics and Security Aware Predictive Spectrum Sharing with Active and Passive Users", National Science Foundation (NSF), $1,008,250, Co-PI, with R. Berry, Y. Guan, J. Hester, A. Khokhar and G. Trajcevski, 01/01/2021-12/31/2023

F4 "Institute for Data, Econometrics, Algorithms and Learning (IDEAL)", National Science Foundation (NSF), $3,427,500, senior personnel, with A. Blum, L. Reyzin, A. Vijayaraghavan and many others, 09/01/2022-08/31/2027

F5 "Improved Hybrid Interior-Point/Active-Set PSCOPF Algorithms Exploiting Power System Characteristic", Department of Energy Advanced Research Projects Agency–Energy (ARAP-E) Grid Optimization (GO) Competition Challenge II, $ 400,000, Co-PI, with F. Curtis, D. Molzahn, A. Wächter and E. Wong, 08/01/2020-07/31/2022

F6 "Hybrid Interior-Point/Active-Set PSCOPF Algorithms Exploiting Power System Characteristics", Department of Energy Advanced Research Projects Agency–Energy (ARPA-E) Grid Optimization (GO) Competition Challenge I, $ 250,000, Co-PI, with F. Curtis, D. Molzahn, A. Wächter and E. Wong, 12/13/2018 – 12/12/2019

F7 "Novel Optimization Methods for Stochastic Data-Driven Nonconvex Optimization", Department of Defense Defense Advanced Research Projects Agency (DARPA) Lagrange, $ 75,000, Co-PI, with J. Nocedal, K. Scheinberg, 1/1/2018-6/30/2019

F8 "Systematic Modeling and Analysis of Electricity Market with Demand Response", Finite Earth Initiatives support provided by Leslie and Mac McQuown, $ 260,000, PI, 2017-2022

STUDENTS AND POSTDOCS SUPERVISED

S1 H. Abrahamson (current ECE PhD student).

S2 L. Yi (current ECE PhD student).

S3 S. Bhattacharya (current IEMS PhD student).

S4 Z. Sun (current ECE PhD student).

S5 X. Niu (current IEMS PhD student).

S6 C. Iakovidou (former ECE PhD student). PhD Thesis: "Distributed Optimization Methods In Large-Scale Systems With Realistic Constraints", 2022. Currently at Argonne National Laboratory.

S7 S. Tu (former IEMS PhD student). PhD Thesis: "Two-Stage Decomposition Algorithms and Their Application to Optimal Power Flow Problems", 2021. Currently at Twitter, Inc.

S8 B. Badia (former ECE PhD student). PhD Thesis: "Modeling competition and the integration of modern grid technologies in two-tiered emerging electricity markets", 2021. Currently at AutoGrid.

S9 F. Mansoori (former ECE PhD student). PhD Thesis: "Methods for Large-Scale Distributed Optimization", 2020. Currently at Boston Consulting Group (BCG).

S10 D. Xiang (former ECE PhD student). PhD Thesis: "Optimization and Preference Learning for Dynamic Price of Demand Response in Smart Grid", 2020. Currently at The Home Depot.

S11 Ningning Ding (current postdoc).

S12 M. Zhang (former postdoc). Currently at Zhejiang University-University of Illinois at Urbana-Champaign Institute.

S13 H. Yu (former postdoc). Currently at Beijing Institute of Technology.

S14 Y. Xiao (former postdoc). Currently at University of Hawaii at Manoa.

S15 Z. Zeng (current ECE MS student).

S16 J. Liu (current undergraduate research assistant).

S17 D. Lee (former undergraduate research assistant).

S18 X. He (former undergraduate research intern).

S19 E. Hong (former high school research intern).

S20 J. Eberhardt (former high school research intern).

S21 B. Sreenivas (former high school research intern).

S22 M. Shah (former high school research intern).

PhD THESIS COMMITTEES SERVED

T1 X. Liu. PhD in progress. Supervised by Q. Zhu

T2 X. Luo. PhD in progress. Supervised by A. Wächter

T3 I. Ridgley. PhD in progress. Supervised by R. Freeman

T4 L. Wang. "On the Theory of Deep Reinforcement Learning: Global Convergence and Sample Efficiency", 2022. Supervised by Z. Wang

T5 Z. Fu. "On the Optimality and Complexity of Reinforcement Learning", 2022. Supervised by Z. Wang

T6 S. Lan. "Efficient and Adaptive Computer Vision for Cyber-physical Systems", 2021. Supervised by Q. Zhu

T7 C. Kim. "Optimization Methods for Scale Invariant Problems in Machine Learning", 2020. Supervised by D. Klabjan

T8 V. R. Bollapragada. "Methods for Deterministic and Stochastic Optimization", 2019. Supervised by J. Nocedal

T9 J. Mays. "Pricing Mechanisms in Competitive Electricity Markets", 2019. Supervised by D. Morton

T10 X. Wang. "Wireless Spectrum: Policy, Economics and Applications", 2019. Supervised by R. Berry

T11 Y. Xie. "Quasi-Newton Methods for Nonsmooth and Noised Problems", 2019. Supervised by J. Nocedal

T12 R. Keating. "Multiuser Ranging and Localization for Future Networks", 2018. Supervised by D. Guo

T13 B. Van Scoy. "Analysis and Design of Algorithms for Dynamic Average Consensus and Convex Optimization", 2017. Supervised by R. Freeman

T14 Y. Zhu. "Economics of Wireless Spectrum Sharing: Contracts and MVNOs", 2018. Supervised by R. Berry

T15 Z. Zhou. "Centralized Radio Resource Management for Metropolitan Area Networks", 2018. Supervised by D. Guo

T16 T. Le. "Bayesian Observational Learning: When More Information Can Fail", 2017. Supervised by R. Berry

T17 C. Liu. "Investment and Competition with Shared Spectrum", 2016. Supervised by R. Berry

T18 B. Zhuang. "Interference and Resource Management in Heterogeneous Cellular Netowrks", 2014. Supervised by D. Guo and M. Honig

SELECTED INVITED TALKS

I1 RSRG/FALCON Tea at California Institute of Technology, 2022

I2 Daniel J. Epstein Department of Industrial & Systems Engineering Seminar at University of Southern California, 2022

I3 Electrical and Computer Engineering Department Seminar at Carnegie Mellon University, 2022

I4 Signal and Information Processing Seminar at Rutgers University, 2020

I5 Seminar on Mathematics of Imaging Sciences, Data Sciences, and Optimization at Rensselaer Polytechnic Institute, 2020

I6 Yahoo! Research Seminar, 2019

I7 Facebook Seminar, 2018

I8 International Symposium on Mathematical Programming (ISMP) 2018

I9 Midwest Machine Learning Symposium 2018

I10 DIMACS (Center for Discrete Mathematics Theoretical Computer Science) Workshop on Distributed Optimization, Information Processing and Learning 2017

I11 System Information Learning Optimization (SILO) seminar, University of Wisconsin, Madison, 2017

I12 IEEE Conference on Decision and Control (CDC) 2010, 2012, 2017, 2019, 2021, 2022

I13 INFORMS annual meeting 2013-present

I14 SIAM Optimization Conference 2017

I15 Systems Information Learning Optimization Seminar at University of Wisconsin, Madison, 2017

I16 Midwest Workshop on Control and Game Theory 2016, 2017

I17 International Conference on Continuous Optimization (ICCOPT) 2016

I18 American Control Conference (ACC) 2017

I19 Information Theory and Applications Workshop (ITA) 2017, 2022

I20 Asilomar Conference on Signals, Systems and Computers 2015, 2016

I21 Allerton Conference on Communication, Control and Computing 2015, 2016, 2019, 2022

I22 Global Conference on Signal and Information Processing (GlobalSIP) 2016

I23 Decision and Control Lecture Series Coordinated Science Laboratory at University of Illinois Urbana-Champaign 2015

I24 Ohio State University Seminar 2015

I25 Argonne National Laboratory Seminar 2014

I26 Huawei North America Seminar 2015

I27 IEEE Global Conference on Signal and Information Processing, 2013

I28 Annual Conference on Information Sciences and Systems, 2012

I29 Philips Research Seminar 2012

PROFESSIONAL ACTIVITIES

Conference Organizations

- INFORMS Optimization Society Student Paper Prize Committee 2017
- Technical Program Committee for International Symposium on Theory, Algorithmic Foundations, and Protocol Design for Mobile Networks and Mobile Computing (MobiHoc) 2019, 2022
- Technical Program Committee for Conference on Neural Information Processing Systems (NeurIPS) 2016-Present
- Associate Editor for IFAC Conference on Networked Systems (NecSys) 2022
- Technical Program Committee for International Conference on NETwork Games, Control and Optimisation (Netgcoop) 2019
- Global Conference on Signal and Information Processing Technical Program Committee 2015
- Invited session organizer for Allerton Conference on Communication, Control and Computing 2016
- Invited session organizer for Asilomar Conference on Signals, Systems and Computers 2014
- Invited session organizer for IEEE Conference on Decision and Control CDC 2014-2018, 2022
- Invited session organizer for INFORMS annual meeting annually (except maternity leaves)
- Co-chair for LIDS (Laboratory for Information and Decision System) student conference 2013

Selected Review Services

- IEEE Transactions on Automatic Control
- IEEE Transactions on Control of Network Systems
- IEEE Transactions on Signal and Information Processing

- IEEE Transactions on Control Systems Technology
- IEEE Cyber-Physical Systems
- IEEE Transactions on Smart Grid
- Operations Research
- SIAM Journal on Optimization (SIOPT)
- Mathematical Programming
- American Control Conference
- IEEE Conference on Decision and Control
- National Science Foundation (NSF)
- Department of Energy Advanced Research Projects Agency–Energy (ARPA-E)

Society Memberships

- IEEE
- INFORMS
- SIAM

Department and University Activities

- Electrical and Computer Engineering faculty search committee 2017, 2022
- Electrical and Computer Engineering graduate committee 2020-2022
- Electrical Engineering Undergraduate curriculum committee 2017-2022
- Electrical and Computer Engineering undergraduate recruiting committee 2021
- Electrical and Computer Engineering seminar committee 2014-2020
- The Institute for Sustainability and Energy at Northwestern (ISEN) curriculum advisor 2019
- CO-Organizer of Northwestern ETOPiA (Engineering Transdisciplinary Outreach Projects in the Arts) 2015-Present