Tianyi Chen

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Research Interests

Theory Network Optimization, Machine Learning, Artificial Intelligence, Signal Processing

Applications Internet-of-Things, Cyber-Physical Systems, Smart Grids, Communication Networks

Education

2014 - now **Ph.D.**, Electrical and Computer Engineering - **University of Minnesota, Twin Cities**, **USA**
Advisor: Prof. Georgios B. Giannakis
Thesis: Machine Learning and Resource Management for Internet-of-Things

2014 - 2016 **M.S.**, Electrical and Computer Engineering - **University of Minnesota, Twin Cities**, **USA**
Advisor: Prof. Georgios B. Giannakis
Thesis: Resource Allocation for Green Cloud Networks under Uncertainty: Stochastic, Robust and Data-driven Approaches
ECE Department nominee for the UMN Distinguished Master's Thesis

2010 - 2014 **B.S.**, Communication Science and Engineering - **Fudan University**, **China**
Advisor: Prof. Xin Wang
Thesis: Approximation Algorithms to Several NP-hard Resource Allocation Problems in Wireless Communications

Visiting Experiences

Sep 2018 - Oct 2018 Coordinated Science Laboratory, **University of Illinois at Urbana-Champaign**
Host: Prof. Tamer Başar
Developed scalable reinforcement learning algorithms in distributed settings

Jan 2018 - Feb 2018 Department of Mathematics, **University of California, Los Angeles**
Host: Prof. Wotao Yin
Developed communication-efficient large-scale distributed algorithms for machine learning

Jul 2017 - Aug 2017 The School of Engineering and Applied Sciences, **Harvard University**
Host: Prof. Na Li
Developed algorithms for allocating heterogeneous energy resources in power grids

Publications

I have published in the following flagship journals: Proceedings of the IEEE, IEEE Internet of Things Journal, Journal of Machine Learning Research, IEEE Transactions on Signal Processing, IEEE Journal on Special Topics in Signal Processing, IEEE Journal on Selected Areas in Communications, IEEE Transaction on Wireless Communication, IEEE Transactions on Smart Grid, IEEE Transactions on Control of Network Systems, IEEE Transactions on Parallel and Distributed Systems, IEEE Transaction on Mobile Computing; and in the following top conferences: NeurIPS, AISTATS, AAAI, ICASSP, GLOBECOM, GlobalSIP, SPAWC, Asilomar, ACC.

Journal Papers (appeared/to appear)

J1. **T. Chen**, S. Barbarossa, X. Wang, G. B. Giannakis, and Z.-L. Zhang, "Learning and Management for Internet-of-Things: Accounting for Adaptivity and Scalability," *Proceedings of the IEEE*, May 2019.

J2. Y. Shen, **T. Chen**, and G. B. Giannakis, "Random Feature-based Online Multi-kernel Learning in Environments with Unknown Dynamics," *Journal of Machine Learning Research*, to appear 2019.

J3. **T. Chen**, Q. Ling, Y. Shen, and G. B. Giannakis, "Heterogeneous Online Learning for "Thing-Adaptive" Fog Computing in IoT," *IEEE Internet of Things Journal*, to appear 2019.

J4. X. Chen, W. Ni, **T. Chen**, I. B. Collins, X. Wang, and G. B. Giannakis, "Multi-Timescale Online Optimization of Network Function Virtualization for Service Chaining," *IEEE Transaction on Mobile Computing*, to appear 2019.

J5. **T. Chen** and G. B. Giannakis, "Bandit Convex Optimization for Scalable and Dynamic IoT Management," *IEEE Internet of Things Journal*, to appear 2018.

J6. B. Li, **T. Chen**, X. Wang, and G. B. Giannakis, "Real-time Optimal Energy Management with Reduced Battery Capacity Requirements," *IEEE Transactions on Smart Grid*, to appear 2018.

J7. **T. Chen**, Q. Ling, and G. B. Giannakis, "Learn-and-Adapt Stochastic Dual Gradients for Network Resource Allocation," *IEEE Transactions on Control of Network Systems*, to appear 2018.

J8. X. Wang, X. Chen, **T. Chen**, L. Huang, and G. B. Giannakis, "Two-Scale Stochastic Control for Multipoint Communication Systems with Renewables," *IEEE Transactions on Smart Grid*, vol. 9, no. 3, pp. 1822-1834, May 2018.

J9. **T. Chen**, Q. Ling, and G. B. Giannakis, "An Online Convex Optimization Approach to Proactive Network Resource Allocation," *IEEE Transactions on Signal Processing*, vol. 65, no. 24, pp. 6350-6364, December 2017.

J10. X. Chen, W. Ni, **T. Chen**, I. B. Collins, X. Wang, and G. B. Giannakis, "Real-time Energy Trading and Future Planning for Fifth-Generation Wireless Communications," *IEEE Wireless Communications Magazine*, vol. 24, no. 4, pp. 24-30, August 2017.

J11. **T. Chen**, A. G. Marques, and G. B. Giannakis, "DGLB: Distributed Stochastic Geographical Load Balancing with Incentive Payment," *IEEE Transactions on Parallel and Distributed Systems*, vol. 28, no. 7, pp. 1866-1880, July 2017.

J12. **T. Chen**, A. Mokhtari, X. Wang, A. Ribeiro, and G. B. Giannakis, "Stochastic Averaging for Constrained Optimization with Application to Online Resource Allocation," *IEEE Transactions on Signal Processing*, vol. 65, no. 12, pp. 3078-3093, June 2017.

J13. X. Wang, **T. Chen**, X. Chen, X. Zhou, and G. B. Giannakis, "Dynamic Resource Allocation for Smart-Grid Powered MIMO Downlink Transmissions," *IEEE Journal on Selected Areas in Communications*, vol. 34, no. 12, pp. 3354 - 3365, December 2016.

J14. X. Wang, Y. Zhang, **T. Chen**, and G. B. Giannakis, "Dynamic Energy Management for Smart-Grid Powered Coordinated Multipoint Systems," *IEEE Journal on Selected Areas in Communications*, vol. 34, no. 5, pp. 1348-1359, May 2016.

J15. **T. Chen**, Y. Zhang, X. Wang, and G. B. Giannakis, "Robust Workload and Energy Management for Sustainable Data Centers," *IEEE Journal on Selected Areas in Communications*, vol. 34, no. 3, pp. 651-654, March 2016.

J16. **T. Chen**, X. Wang, and G. B. Giannakis, "Cooling-Aware Energy and Workload Management in Data Centers via Stochastic Optimization," *IEEE Journal on Special Topics in Signal Processing*, vol. 10, no. 2, pp. 402-405, March 2016.

J17. Z. Nan, **T. Chen**, X. Wang and W. Ni, "Energy-Efficient Transmission Schedule for Delay-Limited Bursty Data Arrivals under Non-Ideal Circuit Power Consumption," *IEEE Transaction on Vehicular Technology*, Vol. 65, No. 8, pp. 6588 - 6600, August 2016.

J18. **T. Chen**, H. Shan and X. Wang, "Optimal Scheduling for Wireless On-Demand Data Packet Delivery to High-Speed Trains," *IEEE Transaction on Vehicular Technology*, Vol. 64, No. 9, pp. 4101 - 4112, September 2015.

J19. X. Wang, Z. Nan and **T. Chen**, "Optimal MIMO Broadcasting for Energy Harvesting Transmitter with Non-ideal Circuit Power Consumption," *IEEE Transaction on Wireless Communication*, Vol. 14, No. 5, pp. 2500 - 2512, May 2015.

Journal Papers (submitted)

JS1. **T. Chen**, K. Zhang, G. Giannakis, and T. Başar, "Communication-Efficient Distributed Reinforcement Learning," *Journal of Machine Learning Research*, submitted November 2018.
[available online]: https://arxiv.org/pdf/1812.03239.pdf

JS2. B. Li, **T. Chen**, and G. B. Giannakis, "Non-stochastic Multi-armed Bandit with Unknown Delays," *IEEE Transactions on Signal Processing*, submitted November 2018.

JS3. **T. Chen**, G. Giannakis, T. Sun and W. Yin, "Lazily Aggregated Gradient for Communication-Efficient Distributed Machine Learning," *Journal of Machine Learning Research*, submitted October 2018.

JS4. B. Li, **T. Chen**, and G. B. Giannakis, "Secure Mobile Edge Computing in IoT via Collaborative Online Learning," *IEEE Transactions on Signal Processing*, submitted September 2018.

Conference Papers

C1. L. Li, W. Xu, **T. Chen**, G. B. Giannakis, and Q. Ling, "RSA: Byzantine-Robust Stochastic Aggregation Methods for Distributed Learning from Heterogeneous Datasets," *Proc. of AAAI Conf. on Artificial Intelligence* (**AAAI**), Honolulu, USA, January 27 - February 1, 2019.

C2. **T. Chen**, G. Giannakis, T. Sun and W. Yin, "LAG: Lazily Aggregated Gradient for Communication-Efficient Distributed Learning," *Proc. of Neural Information Processing Systems* (**NeurIPS**), Montreal, Canada, December 3-8, 2018. (**Spotlight**: Top 4% of all submitted papers)

C3. Y. Shen*, **T. Chen***, and G. B. Giannakis, "Online Ensemble Multi-kernel Learning Adaptive to Non-stationary and Adversarial Environments," *Proc. of Intl. Conf. on Artificial Intelligence and Statistics* (**AISTATS**), Lanzarote, Canary Islands, April 9-11, 2018. (**equal contribution**)

C4. B. Li, **T. Chen**, X. Wang, and G. B. Giannakis, "Secure Edge Computing in IoT via Online Learning," *Proc. of Asilomar Conf. on Signals, Systems, and Computers*, Pacific Grove, CA, October 28-31, 2018.

C5. **T. Chen**, N. Li, and G. B. Giannakis, "Aggregating Flexibility of Heterogeneous Energy Resources in Distribution Networks," *Proc. of American Control Conference* (**ACC**), Milwaukee, WI, June 27-29, 2018.

C6. **T. Chen** and G. B. Giannakis, "Harnessing Bandit Online Learning for Low-Latency Fog Computing," *Proc. of Intl. Conf. on Acoustics, Speech, and Signal Process.* (**ICASSP**), Calgary, Canada, April 15-20, 2018.

C7. Y. Shen, **T. Chen**, and G. B. Giannakis, "Online Multi-Kernel Learning with Orthogonal Random Features," *Proc. of Intl. Conf. on Acoustics, Speech, and Signal Processing* (**ICASSP**), Calgary, Canada, April 15-20, 2018.

C8. B. Li, **T. Chen**, X. Wang, and G. B. Giannakis, "Real-Time Energy Management with Improved Cost-Capacity Tradeoff," *Proc. GlobalSIP*, Montreal, Canada, Nov. 14-16, 2017.

C9. **T. Chen**, Y. Shen, and G. B. Giannakis, "Online Learning for 'Thing-Adaptive' Fog Computing in IoT," *Proc. of Asilomar Conf.*, Pacific Grove, CA, Oct. 29 - Nov. 1, 2017. **Best Student Paper Award Finalist**

C10. **T. Chen**, Q. Ling, and G. B. Giannakis, "Online Convex Optimization for Dynamic Network Resource Allocation," *Proc. of EUSIPCO*, Kos Island, Greece, Aug. 28 - Sept. 3, 2017.

C11. **T. Chen**, Q. Ling, and G. B. Giannakis, "Learn-and-Adapt Network Resource Allocation," *Proc. of SPAWC*, Hokkaido, Japan, July 3-6, 2017.

C12. **T. Chen**, A. Mokhtari, X. Wang, A. Ribeiro, and G. B. Giannakis, "A Data-driven Approach to Stochastic Network Optimization," *Proc. of GlobalSIP*, Washington, DC, Dec. 7-9, 2016.

C13. X. Chen, **T. Chen**, X. Wang, L. Huang, and G. B. Giannakis, "Two-Scale Stochastic Control for Smart-Grid Powered Coordinated Multi-Point Systems," *Proc. of Globecom Conf.*, Washington, DC, Dec. 4-8, 2016.

C14. **T. Chen**, A. G. Marques, and G. B. Giannakis, "Space-Time Scheduling For Green Data Center Networks," *Proc. of Asilomar Conf.*, Pacific Grove, CA, Nov. 6-9, 2016.

C15. **T. Chen**, Y. Zhang, X. Wang, and G. B. Giannakis, "Robust Geographical Load Balancing for Sustainable Data Centers," *Proc. of Intl. Conf. on Acoust., Speech, and Signal Processing*, Shanghai, China, March 20-25, 2016.

C16. **T. Chen**, X. Wang, and G. B. Giannakis, "Energy and Workload Management for Data Centers in Renewable-Integrated Power Grid," *Proc. GlobalSIP*, Orlando, FL, Dec. 14-16, 2015.

C17. X. Wang, **T. Chen**, Y. Zhang and G. B. Giannakis, "Optimal Dynamic Power Management for Green Coordinated Multipoint Systems," *Proc. Globecom*, San Diego, CA, Dec. 6-10, 2015.

C18. **T. Chen**, H. Shan, and X. Wang, "Packet Scheduling for On-Demand Data Services to High-Speed Trains over Wireless Links," *Proc. Globecom*, Atlanta, GA, Dec. 9-13, 2013

Preprint

P1. B. Li, **T. Chen**, and G. B. Giannakis, "Bandit Online Learning with Unknown Delays," *Proc. of Intl. Conf. on Artificial Intelligence and Statistics* (**AISTATS**), Naha, Japan, 2019.
[available online]: https://arxiv.org/pdf/1807.03205.pdf

Tutorial Lectures

December 2018 **Interactive Learning for Optimizing IoT Management**
IEEE Global Communications Conference, Abu Dhabi, UAE

October 2018 **Resilient and Scalable Interactive Learning**
IEEE Military Communication Conference, Los Angeles, CA

Funding Experience

Proposal drafting *Learn-and-Adapt to Manage Dynamic Cyber-Physical Networks*
NSF CCSS 1711471, 2017-2020; built on **[J6, J7, J9, J12]**

Proposal drafting *Interactive Learning for Optimizing IoT Management with Unknown Dynamics*
NSF EPCN, 2019-2022, pending

Proposal drafting *Scalable Learning for IoT with Adaptivity and Privacy*
NSF IIS, 2019-2022, pending

Mentorship Experience

Bingcong Li Ph.D. student, University of Minnesota
Fall 2016 - Spring 2017 Stochastic network optimization for smart grids; see **[J6, C8]**
Fall 2017 - Present Delayed online learning for secure edge computing; see **[JS2, JS4, C4, P1]**

Jun Sun Visiting Ph.D. student, University of Minnesota
Summer 2018 - Present Distributed reinforcement learning for mobile edge computing

Awards and Honors

2018	NeurIPS Student Travel Grant Award
2018	ECE-UMN representative for the ITA Graduation Day
2017	**Doctoral Dissertation Fellowship (DDF), UMN**
2017	DDF Conference Presentation Grant
2017	**Best Student Paper Award Finalist, Asilomar**
2016	NSF Student Travel Grant Award for GlobalSIP
2014	Graduate School Fellowship, UMN
2013	**National Scholarship (Top 1%), China**
2013	Fudan Scholarship for Academic Innovation (Top 1%)
2013	IEEE COMSOC Student Travel Grant Award for Globecom
2012	**Best Demo Award, International Conference on the Internet-of-Things**
2012	1st Prize of Yongling Liu Fellowship (Top 2%)
2012	Fudan Best Students Award
2011	3rd Prize of Fudan Students Fellowship

Selected Talks

- "Interactive Learning for Optimizing IoT Management"
  IEEE Global Communications Conference, Abu Dhabi, UAE, December 2018.
- "LAG: Lazily Aggregated Gradient for Communication-Efficient Distributed Learning"
  Neural Information Processing Systems, Montreal, Canada, December 2018.
- "Distributed Machine Learning for IoT: Accounting for Heterogeneity and Scalability"
  Fudan University, Shanghai, China, November 2018.
- "Resilient and Scalable Interactive Learning"
  IEEE Military Communication Conference, Los Angeles, CA, October 2018
- "Distributed Machine Learning for IoT: Accounting for Heterogeneity and Scalability"
  University of Illinois at Urbana-Champaign, Urbana, IL, September 2018
- "Harnessing Bandit Online Learning for Low-Latency Fog Computing"
  Intl. Conf. on Acoustics, Speech, and Signal Process., Calgary, Canada, April 2018
- "Harnessing Bandit Online Learning for Low-Latency Fog Computing"
  Information Theory and Applications Workshop, San Diego, CA, February 2018
- "Real-Time Energy Management with Improved Cost-Capacity Tradeoff"
  IEEE Global Conf. on Signal and Information Process., Montreal, Canada, November 2017
- "Online Learning for 'Thing-Adaptive' Fog Computing in IoT"
  Asilomar Conf. on Signals, Systems, & Computers, Pacific Grove, CA, October 2017
- "Online Learning with Constraints for Dynamic Network Management"
  Harvard University, Cambridge, MA, July 2017
- "Online Learning with Constraints for Dynamic Network Management"
  University of Science and Technology of China, Hefei, China, June 2017
- "A Data-driven Approach to Stochastic Network Optimization"
  IEEE Global Conf. on Signal and Information Process., Washington, DC, December 2016

Professional Services

Conference committee	IEEE Vehicular Technology Conference, 2018, 2019 IEEE Data Science Workshop, 2019 IEEE Global Conference on Signal and Information Processing, 2017, 2018
Journal reviewer	IEEE Transactions on Automatic Control IEEE Transactions on Control of Network Systems IEEE Transactions on Communications IEEE Internet of Things Journal IEEE Journal on Selected Areas in Communications IEEE/ACM Transactions on Networking IEEE Transactions on Smart Grid IEEE Transactions on Signal Processing IEEE Signal Processing Letter IEEE Transactions on Signal and Information Processing over Networks IEEE Transactions on Vehicular Technology IEEE Transaction on Wireless Communications EURASIP Journal on Advances in Signal Processing
Conference reviewer	IEEE American Control Conference IEEE Conference on Decision and Control IEEE Global Communication Conference IEEE Global Conference on Signal and Information Processing IEEE International Conference on Communications IEEE International Conference on Acoustics, Speech, and Signal Processing IEEE Vehicular Technology Conference