

Xiugang Wu

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Research Interests

- Machine Learning, Statistical Inference, Data Science
- Information Theory, Wireless Communications and Networks, Data Center Networks

Education

University of Waterloo, Waterloo, Ontario, Canada 06/2014

- *Doctor of Philosophy*, Electrical & Computer Engineering
- Thesis: *Coding Schemes for Multiple-Relay Channels*

University of Waterloo, Waterloo, Ontario, Canada 06/2009

- *Master of Applied Science*, Electrical & Computer Engineering

Tongji University, Shanghai, China 06/2007

- *Bachelor of Engineering (Rank: 1/123)*, Electronic & Information Engineering

Employment

University of Delaware, Newark, DE

- *Assistant Professor*, Department of Electrical & Computer Engineering 09/2018–Present
- *Assistant Professor*, Department of Computer & Information Systems 09/2018–Present
- *Affiliated Faculty*, Data Science Institute 09/2018–Present

Stanford University, Stanford, CA

- *Postdoctoral Fellow*, Department of Electrical Engineering 01/2015–05/2018

University of Waterloo, Waterloo, Ontario, Canada

- *Research Assistant*, Department of Electrical & Computer Engineering 09/2007–12/2014

Honors and Awards

- NSF Center for Science of Information (CSoI) Postdoctoral Fellowship 2017
- University of Waterloo Graduate Scholarship, University of Waterloo 2010–2013
- Faculty of Engineering Graduate Scholarship, University of Waterloo 2008, 2012
- Best Speaker Award, ECE Graduate Student Research Talks, University of Waterloo 2011
- Distinguished Honor Graduate of Shanghai City, Shanghai, China 2007

Invited Presentations

- “Information Constrained Optimal Transport: From Talagrand, to Marton, to Cover”
 - Information Theory and Applications Workshop (ITA), UCSD, Feb. 2020
 - The 2nd TBSI Workshop on Learning Theory, Tsinghua-Berkeley Shenzhen Institute, July 2020
 - Youtube Shannon Channel, Sept. 2020
 - Beyond IID Workshop in Information Theory, Nov. 2020
- “Capacity upper bounds for the relay channel: geometric and functional approaches”
 - Conference on Information Sciences and Systems (CISS), JHU, Mar. 2019
- “Minimax learning for remote prediction”
 - Banff Workshop on “Intersection of Information Theory and Signal Processing: New Signal Models, their Information Content and Acquisition Complexity”, Oct. 2018
- “Fundamental limits in information networks: Communication, inference and learning”
 - Dept. of ECE, Cornell University, April 2018
 - Dept. of ECE, University of Toronto, August 2018
 - Dept. of ECE, Dept. of CIS, University of Delaware, Sept. 2018
 - Dept. of CIS, Temple University, Dec. 2018
 - Dept. of ECE, Rutgers University, Mar. 2019
- “Information theory, geometry, and Cover’s open problem”
 - Information Theory Forum, Dept. of EE, Stanford University, Feb. 2017
- “Cover’s open problem: “The capacity of the relay channel””
 - Dept. of ECE, McMaster University, Oct. 2016
 - Information Theory and Applications Workshop (ITA), UCSD, Feb. 2017
- “Improving on the cut-set bound via geometric analysis of typical sets”
 - Dept. of ECE, McMaster University, Oct. 2015
 - Dept. of ECE, University of Toronto, Oct. 2015
 - Information Theory Forum, Dept. of EE, Stanford University, Jan. 2016
 - BLISS Seminar, Dept. of EECS, UC Berkeley, Feb. 2016
- “Proving converses for multi-user problems via measure concentration”
 - Information Theory and Applications Workshop (ITA), UCSD, Feb. 2016
- “Recent progress on relay channels: coding schemes and upper bounds”
 - Dept. of ECE, University of Toronto, Oct. 2014

Publications

Book Chapters

- [B1] **X. Wu**, Network Information Theory. In: X. Shen, X. Lin, K. Zhang (eds) Encyclopedia of Wireless Networks, Springer, 2018.

Journals

- [J1] Y. Bai, **X. Wu**, A. Ozgur, Information Constrained Optimal Transport: From Talagrand, to Marton, to Cover, Submitted to *IEEE Trans. Inform. Theory*, August 2020.
- [J2] C. T. Li, **X. Wu**, A. Ozgur, A. El Gamal, “Minimax learning for remote prediction,” *IEEE Trans. Inform. Theory*, vol. 66, pp. 7929–7938, December 2020.
- [J3] **X. Wu**, L. Barnes, A. Ozgur, ““The capacity of the relay channel”: Solution to Cover’s problem in the Gaussian Case,” *IEEE Trans. Inform. Theory*, vol. 65, pp. 255–275, January 2019.
- [J4] **X. Wu** and A. Ozgur, “Cut-set bound is loose for Gaussian relay networks,” *IEEE Trans. Inform. Theory*, vol. 64, pp. 1023–1037, February 2018.
- [J5] **X. Wu**, A. Ozgur, and L.-L. Xie, “Improving on the cut-set bound via geometric analysis of typical sets,” *IEEE Transactions on Information Theory*, vol. 63, pp. 2254–2277, April 2017.
- [J6] **X. Wu**, S. Zhang and A. Ozgur, “STAC: Simultaneous Transmitting and Air Computing in wireless data center networks,” *IEEE Journal on Selected Areas in Communications*, vol. 34, pp. 4024–4034, Dec. 2016.
- [J7] **X. Wu** and L.-L. Xie, “A unified relay framework with both D-F and C-F relay nodes,” *IEEE Transactions on Information Theory*, vol. 60, no.1, pp. 586–604, January 2014.
- [J8] **X. Wu** and L.-L. Xie, “On the optimal compressions in the compress-and-forward relay schemes,” *IEEE Transactions on Information Theory*, vol. 59, no. 5, pp. 2613–2628, May 2013.

Conferences

- [C1] D. Reshetova, Y. Bai, **X. Wu**, A. Ozgur, “Understanding Entropic Regularization in GANs,” *2021 International Symposium on Information Theory*.
- [C2] Y. Bai, **X. Wu**, A. Ozgur, “Information Constrained Optimal Transport: From Talagrand, to Marton, to Cover,” *2020 International Symposium on Information Theory*.
- [C3] **X. Wu**, A. Ozgur, M. Peleg, S. Shamai, “New Upper Bounds on the Capacity of Primitive Diamond Relay Channels,” *2019 IEEE Information Theory Workshop*.
- [C4] C. T. Li, **X. Wu**, A. Ozgur, A. El Gamal, “Minimax learning for remote prediction,” *2018 International Symposium on Information Theory*, Colorado, USA, June, 2018.
- [C5] L. Barnes, **X. Wu**, A. Ozgur, “A solution to Cover’s problem for the binary symmetric relay channel: Geometry of sets on the Hamming sphere,” in *Proc. of 55th Annual Allerton Conference on Communication, Control, and Computing*, Allerton Retreat Center, Monticello, Illinois, 2017.
- [C6] **X. Wu**, L. Barnes, A. Ozgur, “The geometry of the relay channel,” in *Proc. of IEEE International Symposium on Information Theory*, Aachen, Germany, June 2017.
- [C7] **X. Wu**, L. Barnes, A. Ozgur, “Cover’s open problem: “The capacity of the relay channel”,” in *Proc. of 54th Annual Allerton Conference on Communication, Control, and Computing*, Allerton Retreat Center, Monticello, Illinois, 2016. (Invited)
- [C8] **X. Wu**, A. Ozgur, “Improving on the cut-set bound for general primitive relay channels,” in *Proc. of IEEE International Symposium on Information Theory*, Barcelona, Spain, Jul. 2016.
- [C9] **X. Wu**, A. Ozgur, “Improving on the cut-set bound via geometric analysis of typical sets,” in *Proc. of 2016 International Zurich Seminar on Communications*, Zurich, Mar. 2016.
- [C10] **X. Wu**, A. Ozgur, “Cut-set bound is loose for Gaussian relay networks,” in *Proc. of 53rd Annual Allerton Conference on Communication, Control, and Computing*, Allerton Retreat Center, Monticello, Illinois, Sept. 29–Oct. 1, 2015.
- [C11] **X. Wu**, L.-L. Xie, A. Ozgur, “Upper bounds on the capacity of symmetric primitive relay channels,” in *Proc. of IEEE International Symposium on Information Theory 2015*, Hong Kong, June 14–19, 2015.

- [C12] S. Zhang, **X. Wu**, A. Ozgur, “STAC: Simultaneous Transmitting and Air Computing in wireless data center networks,” in *Proc. of IEEE/CIC International Conference on Communications in China*, Shenzhen, China, Nov. 2–4, 2015.
- [C13] Z. Ma, **X. Wu**, H. Xu, “Understanding the degree distribution pattern of protein-protein interaction networks,” in *Proc. of IEEE International Symposium on Bioelectronics and Bioinformatics*, Beijing, China, Oct. 14–17, 2015.
- [C14] **X. Wu** and L.-L. Xie, “A unified relay framework with both D-F and C-F relay nodes,” in *Proc. of the 13th Canadian Workshop on Information Theory*, Toronto, Canada, June 18–21, 2013.
- [C15] **X. Wu** and L.-L. Xie, “Codebook information does not reduce output entropy when rate is above capacity,” in *Proc. of 48th Annual Allerton Conference on Communication, Control, and Computing*, Allerton Retreat Center, Monticello, Illinois, Sept. 29–Oct. 1, 2010. (Invited)
- [C16] **X. Wu** and L.-L. Xie, “On the optimality of successive decoding in compress-and-forward relay schemes,” in *Proc. of 48th Annual Allerton Conference on Communication, Control, and Computing*, Allerton Retreat Center, Monticello, Illinois, Sept. 29–Oct. 1, 2010. (Invited)
- [C17] **X. Wu** and L.-L. Xie, “An optimality-robustness tradeoff in the compress-and-forward relay scheme,” in *Proc. of IEEE 72nd Vehicular Technology Conference*, Ottawa, Sept. 2010.
- [C18] **X. Wu** and L.-L. Xie, “AEP of output when rate is above capacity: the Gaussian case,” in *Proc. of IEEE International Symposium on Information Theory 2010*, Austin, Texas, U.S.A., June 13–18, 2010.
- [C19] **X. Wu** and L.-L. Xie, “AEP of output when rate is above capacity,” in *Proc. of the 11th Canadian Workshop on Information Theory*, Ottawa, Canada, May 13–15, 2009.

Teaching

Instructor, University of Delaware

- ELEG/CISC 867 - Advanced Machine Learning, Spring 2019
- ELEG 667 - Convex Optimization, Fall 2019
- ELEG 310 - Random Signals and Noise, Spring 2020, Spring 2021
- ELEG 602 - Advanced Machine Learning, Fall 2020, Fall 2021

Assistant Instructor, Stanford University

- EE 279 - Introduction to Digital Communication, Winter 2016
- EE 379 - Digital Communication, Spring 2016

Students Supervised

PhD Students

- Yikun Bai. Started in Spring 2019; Passed Qualifying Exam
Research Topic: Optimal Transport for Machine Learning
Anticipated Date of Graduation: Fall 2022
- Yalin Liao. Started in Spring 2020
Research Topic: Information Theory and Machine Learning
Anticipated Date of Graduation: Fall 2024

Master Students

- Bowen Li. Started in Fall 2018
Research Topic: Generative Adversarial Networks
Anticipated Date of Graduation: Spring 2021
- Zhihao Zhang. Started in Fall 2020
Research Topic: Quantum Information
Anticipated Date of Graduation: Fall 2022

Undergraduate Students

- Zhihao Zhang. Interned at Summer 2019
Research Topic: Multi-Arm Bandit and Reinforcement Learning

Graduate Thesis Committee Member

- Yulin Zhang, PhD Proposal Defense and PhD Defense (Advisor: Xiaoming Li)
- Yidan Hu, PhD Proposal Defense (Advisor: Rui Zhang)

Professional Activities and Services

- **Journal Editor**
 - Special Issue “Multi-user Information Theory” on Entropy, 2020-2021
- **Conference TPC Member**
 - IEEE International Symposium on Information Theory (ISIT), 2020
- **Conference Session Organizer**
 - Conference on Information Sciences and Systems (CISS), 2019
- **Conference Session Chair**
 - Conference on Information Sciences and Systems (CISS), 2019
 - Information Theory and Application Workshop (ITA), 2017
 - IEEE Vehicular Technology Conference (VTC), 2010
- **Reviewer (Journals)**
 - IEEE Transactions on Information Theory
 - IEEE/ACM Transactions on Networking
 - IEEE Transactions on Communications
 - IEEE Transactions on Wireless Communications
 - IEEE Transactions on Vehicular Technology
 - IEEE Communications Letters
 - IET Communications
 - Entropy
 - Journal of Systems Science and Complexity (Springer)
 - Ad Hoc Networks (Elsevier)
- **Reviewer (Conferences)**
 - IEEE International Symposium on Information Theory (ISIT)
 - IEEE Information Theory Workshop (ITW)
 - International Symposium on Information Theory and Its Applications (ISITA)
 - IEEE Global Telecommunications Conference (GLOBECOM)
 - IEEE Wireless Communications and Networking Conference (WCNC)
- **Panelist and Reviewer for Proposals**
 - NSF/Intel Partnership on Machine Learning for Wireless Networking Systems, 2020

University Services

- Organizing Committee Member of ECE Department Seminar Series, University of Delaware, 2021
- Research Day Committee Member, Department of ECE, University of Delaware, 2020–2021
- Cluster Faculty Search Committee Member, Foundation of Data Science Opening, University of Delaware, 2019–2020
- Organizing Committee Member, Data Science Symposium, University of Delaware, 2019
- Faculty Search Committee Member, Information and Data Science Opening, Department of ECE, University of Delaware, 2018–2019
- UD ECE Research Day Poster Judge, Department of ECE, University of Delaware, 2019