Hao Wang

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Professional Experience

MIT-IBM Watson AI Lab — **Cambridge, MA**
Postdoctoral Researcher — *Sept. 2022 – present*

Harvard University — **Cambridge, MA**
Postdoctoral Fellow — *July 2022 – Sept. 2022*

IBM Thomas J. Watson Research Center — **Yorktown Heights, NY**
Research Intern — *May 2019 – Aug. 2019*

Education

Harvard University — **Cambridge, MA**
Ph.D. in Applied Mathematics — *Sept. 2016 – May 2022*
Advisor: Flavio P. Calmon Committee: Demba Ba, Na Li, Salil Vadhan
Thesis: Information Theory for Trustworthy Machine Learning

Harvard University — **Cambridge, MA**
M.S. in Applied Mathematics — *Sept. 2016 – May 2019*

University of Science and Technology of China (USTC) — **Hefei, China**
B.Sc. in Mathematics and Applied Mathematics — *Sept. 2012 – June 2016*

Research Interests

Areas: Information Theory, Statistical Learning Theory, Optimization
Topics: Generalization in Machine Learning, Algorithmic Fairness, Privacy

Awards, Honors, and Scholarships

NeurIPS Outstanding Reviewer Award (top 8% of reviewers) *2021*
Certificate of Distinction in Teaching *2021*
Winning Outreach Video at the ISIT Student Video Exposition (Video) *2020*
ICML Travel Award *2019*
Certificate of Distinction in Teaching *2018*
The 35th Guo Moruo Scholarship (highest honor for USTC students) *2015*
China National Scholarship *2014*

Teaching Experience

ES 201: Decision Theory – Graduate Level Course — *Spring 2021*
Engineering and Applied Sciences | Harvard University — ***Rating: 4.9/5.0***
Section Leader
Improved section (recitation) notes to include advanced topics. Led weekly sections that extended the lectures. Held weekly office hours to address individual questions and guided 20+ students through their final projects.

ES 156: Signals and Systems – Undergraduate Level Course — *Spring 2018*
Engineering and Applied Sciences | Harvard University — ***Rating: 4.8/5.0***
Section Leader
Created new section notes that complemented the lectures. Led weekly sections and office hours. Contributed to the design and grading of the midterm and final exams. Prepared new assignments, graded, and gave feedback to 20+ undergraduate students.

Publications

Journal Publications

H. Wang, R. Gao, and F. P. Calmon, "Generalization Bounds for Noisy Iterative Algorithms Using Properties of Additive Noise Channels," ***Journal of Machine Learning Research*** *(accepted with minor revisions)*, 2022.

H. Wang, H. Hsu, M. Diaz, and F. P. Calmon, "To Split or Not to Split: The Impact of Disparate Treatment in Classification," ***IEEE Transactions on Information Theory***, 2021.

H. Wang, L. Vo, F. P. Calmon, M. Médard, K. R. Duffy, and M. Varia, "Privacy with Estimation Guarantees," ***IEEE Transactions on Information Theory***, 2019.

M. Diaz*, **H. Wang***, F. P. Calmon, and L. Sankar, "On the Robustness of Information-Theoretic Privacy Measures and Mechanisms," ***IEEE Transactions on Information Theory***, 2019. ***Equal contribution**.

H. Wang, "Information Theory for Trustworthy Machine Learning," ***PhD Thesis***, 2022.

Peer-Reviewed Conference Proceedings

H. Jeong, **H. Wang**, and F. P. Calmon, "Fairness without Imputation: A Decision Tree Approach for Fair Prediction with Missing Values," in *AAAI Conference on Artificial Intelligence (**AAAI**)*, 2022. **Oral presentation.**

H. Wang, Y. Huang, R. Gao, and F. P. Calmon, "Analyzing the Generalization Capability of SGLD Using Properties of Gaussian Channels," in *Advances in Neural Information Processing Systems (**NeurIPS**)*, 2021.

H. Wang, H. Hsu, M. Diaz, and F. P. Calmon, "The Impact of Split Classifiers on Group Fairness," in *IEEE International Symposium on Information Theory (**ISIT**)*, 2021.

W. Alghamdi, S. Asoodeh, **H. Wang**, F. P. Calmon, D. Wei, and K. N. Ramamurthy, "Model Projection: Theory and Applications to Fair Machine Learning," in *IEEE International Symposium on Information Theory (**ISIT**)*, 2020.

H. Wang, B. Ustun, and F. P. Calmon, "Repairing without Retraining: Avoiding Disparate Impact with Counterfactual Distributions," in *International Conference on Machine Learning (**ICML**)*, 2019.

H. Wang, M. Diaz, J. C. S. Santos Filho, and F. P. Calmon, "An Information-Theoretic View of Generalization via Wasserstein Distance," in *IEEE International Symposium on Information Theory (**ISIT**)*, 2019.

H. Wang, M. Diaz, F. P. Calmon, and L. Sankar, "The Utility Cost of Robust Privacy Guarantees," in *IEEE International Symposium on Information Theory (**ISIT**)*, 2018.

H. Wang, B. Ustun, and F. P. Calmon, "On the Direction of Discrimination: An Information-Theoretic Analysis of Disparate Impact in Machine Learning," in *IEEE International Symposium on Information Theory (**ISIT**)*, 2018.

H. Wang and F. P. Calmon, "An Estimation-Theoretic View of Privacy," in *Annual Allerton Conference on Communication, Control, and Computing*, 2017.

Workshop Papers

H. Jeong, **H. Wang**, and F. P. Calmon, "Fairness without Imputation: A Decision Tree Approach for Fair Prediction with Missing Values," in *Symposium on Foundations of Responsible Computing (FORC)*, 2022.

W. Alghamdi, H. Hsu, H. Jeong, **H. Wang**, P. W. Michalak, S. Asoodeh, and F. P. Calmon, "Beyond Adult and COMPAS: Fairness in Multi-Class Prediction," in *ICML Workshop on Responsible Decision Making in Dynamic Environments*, 2022.

H. Wang, H. Hsu, M. Diaz, and F. P. Calmon, "To Split or Not to Split: The Impact of Disparate Treatment in Classification," in *Symposium on Foundations of Responsible Computing (FORC)*, 2020.

H. Wang, B. Ustun, and F. P. Calmon, "Avoiding Disparate Impact with Counterfactual Distributions," in *NeurIPS Workshop on Ethical, Social and Governance Issues in AI*, 2018.

News on My Research

My research on "An information-theoretic analysis of disparate impact in ML" has been featured in an article entitled "Just data: How algorithms go bad – and how they can be saved" at the Harvard GSAS alumni magazine.

Selected Presentations

Yale Institute for Network Science (YINS)	*2022*
MIT Institute for Data, Systems, and Society (IDSS)	*2022*
Neural Information Processing Systems (virtual)	*2021*
IEEE International Symposium on Information Theory (virtual)	*2021*
Symposium on Foundations of Responsible Computing (virtual)	*2020*
IBM AI Systems Day	*2019*
International Conference on Machine Learning	*2019*
IEEE International Symposium on Information Theory	*2019*
North American School of Information Theory (poster)	*2019*
Annual New England Machine Learning Day (poster)	*2018*
Annual Allerton Conference on Communication, Control, and Computing	*2017*

Mentorship

- Lisa Vo (Harvard College), 2017 – 2019
  Project: Privacy with estimation guarantees (a paper published in IEEE Trans. Inf. Theory)
- Winston Michalak (Harvard College), 2019 – 2020
  Project: Using ADMM for solving model projection
- Raymond Feng (Harvard College), 2022 – current
  Project: Investigating algorithmic discrimination in the presence of missing values

Professional Service

Conference Reviewer
- IEEE International Symposium on Information Theory (ISIT), 2019 – 2022
- Neural Information Processing Systems (NeurIPS), 2020 – 2022
- International Conference on Learning Representations (ICLR), 2022
- International Conference on Machine Learning (ICML), 2022
- International Conference on Artificial Intelligence and Statistics (AISTATS), 2022
- IEEE Information Theory Workshop (ITW), 2021 – 2022
- The Web Conference (TheWebConf), 2021 – 2022
- ACM Conference on Fairness, Accountability, and Transparency (FAccT), 2020, 2022

Journal Reviewer
- IEEE Transactions on Information Theory (T-IT)
- IEEE Transactions on Information Forensics & Security (T-IFS)
- IEEE Transactions on Automatic Control (TAC)
- IEEE Journal on Selected Areas in Information Theory (JSAIT)
- IEEE Journal of Selected Topics in Signal Processing (JSTSP)

Program Committee
- NeurIPS 2020 Workshop on Fair AI in Finance (FAIF)

Personal

Computer Skills: Python, C, C++, MATLAB, Mathematica
Language: Fluent in English and Chinese
Interests: Basketball, Foosball, Traveling, Gaming, Movie, Music

Membership

IEEE Membership, IEEE Information Theory Society Membership, IEEE Young Professionals