

HENGRUI CAI

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EDUCATION

North Carolina State University (NCSU), United States	Aug 2017 - May 2022 (<i>Expected</i>)
Ph.D. in Statistics, Department of Statistics	Overall GPA: 4.00/4.00
Co-Advisors: Dr. Wenbin Lu and Dr. Rui Song	
Zhejiang University, China	Sep 2013 - June 2017
B.S. in Statistics, School of Mathematical Sciences	Overall GPA: 3.93/4.00
Advanced Honor Class of Engineering Education, Chu Kochen Honors College	

AWARDS AND HONORS

- ENAR Distinguished Student Paper Award, The International Biometric Society, 2020
- Nominated for the Outstanding TA Award, NCSU, 2019 and 2021.
- Mu Sigma Rho, National Statistics Honor Society, NCSU, 2017-Present.
- National Undergraduate Research Fund, 2017
- Meritorious Winner in American Mathematical Contest, 2016

RESEARCH INTEREST

- Causal Inference and Causal Structure Learning
- Reinforcement / Deep Learning
- Policy Optimization and Evaluation
- Precision Medicine

PROFESSIONAL EXPERIENCE AND EMPLOYMENT

- May 2020 - April 2022, *Research Scientist* Internship at **Amazon**, Core AI
- May 2019 - Aug 2019, *Research Scientist* Internship at **Amazon**, Marketing Measurement
- Jan 2017 - Mar 2017, *Data Scientist* Internship at **Didi Chuxing**
- May 2016 - Aug 2016, MITACS Globallink *Research Internship* at **University of Alberta**

PUBLICATIONS

Published/Accepted

1. **Cai, H.***, Shi, C.*, Song, R., & Lu, W. (2021). Deep Jump Learning for Off-Policy Evaluation in Continuous Treatment Settings. *Accepted at the 35th Conference on Neural Information Processing Systems (NeurIPS 2021)*. [Received the Distinguished Student Paper Awards for the 2021 ENAR Spring Meeting.]
2. **Cai, H.**, Song, R., & Lu, W. (2021). ANOCE: Analysis of Causal Effects with Multiple Mediators via Constrained Structural Learning. *Accepted at 9th International Conference on Learning Representations (ICLR 2021)*.
3. **Cai, H.**, Song, R., & Lu, W. (2021). GEAR: On Optimal Decision Making with Auxiliary Data. *Stat*, 10(1):e399.

4. **Cai, H.**, Cen, Z., & Song, R. (2021). MAGNET: Multi-Agent Graph Cooperative Bandits. *Accepted at NeurIPS-21 Causal Inference Challenges in Sequential Decision Making: Bridging Theory and Practice Workshop (Oral)*.
5. **Cai, H.**, Cen, Z., Leng, L., & Song, R. (2021). Periodic-GP: Learning Periodic World with Gaussian Process Bandits. *Accepted at IJCAI-21 Reinforcement Learning for Intelligent Transportation Systems Workshop (Spotlight)*.
6. **Cai, H.**, Lu, W., & Song, R. (2020). On Validation and Planning of An Optimal Decision Rule with Application in Healthcare Studies. In *International Conference on Machine Learning (ICML)* (pp. 1262-1270). PMLR.
7. **Cai, H.**, Mandaviya, C., Levkin, R., & Song, R. (2020). Marketing Experiment Bridging: Time Inverse Bayesian Learning (TIBL). *Accepted at the 8th Amazon Machine Learning Conference (AMLC 2020)*.
8. Yuan, Y., Zhou, Q. M., Li, B., **Cai, H.**, Chow, E. J., & Armstrong, G. T. (2018). A Threshold-free Summary Index of Prediction Accuracy for Censored Time to Event Data. *Statistics in Medicine*, 37(10), 1671-1681.

Preprints/Under Review

1. **Cai, H.**, Lu, W., & Song, R. (2021+). CODA: Calibrated Optimal Decision Making with Multiple Data Sources and Limited Outcome. *arXiv preprint arXiv:2104.10554*.
2. **Cai, H.**, Lu, W., Marceau West R., Mehrotra DV., & Huang, L. (2021+). CAPITAL: Optimal Subgroup Identification via Constrained Policy Tree Search. *arXiv preprint arXiv:2110.05636*.
3. Shen, Y.*, **Cai, H.***, & Song, R. (2021+). Doubly Robust Interval Estimation for Optimal Policy Evaluation in Online Learning. *arXiv preprint arXiv:2110.15501*.
4. **Cai, H.***, Shi, C.*, Song, R., & Lu, W. (2021+). Jump Q-Learning for Individualized Decision Making with Continuous Treatments. *arXiv preprint arXiv:2111.08885*.

(* co-first author)

TEACHING

Lab Instructor for Graduate Course

- ST 703: Statistical Methods I (Fall 2019)
- ST 114: Introduction to Statistical Programming - Python (Spring 2022).

Teaching Fellow for Graduate Courses

- ST 745: Analysis of Survival Data (Spring 2021)
- ST 405/505: Applied Nonparametric Statistics (Fall 2020)
- ST 790: Financial Statistics (Fall 2018)
- ST 511: Introduction to Statistics for Biological Sciences (Fall 2018).

Teaching Fellow for Undergraduate Courses

- ST 422: Introduction to Mathematical Statistics II (Fall 2021)
- ST 311: Introduction to Statistics (Spring 2019)
- ST 312: Introduction to Statistics II (Spring 2018)
- ST 350: Economic and Business Statistics (Fall 2017).

SOFTWARES

- **DJL**: Deep Jump Learning for Off-Policy Evaluation in Continuous Treatment Settings. Available on *GitHub*.
- **ANOCE-CVAE**: Analysis of Causal Effects with Multiple Mediators via Constrained Structural Learning. Available on *GitHub*.
- **CODA**: Calibrated Optimal Decision Making with Multiple Data Sources and Limited Outcome. Available on *GitHub*.
- **CAPITAL**: Optimal Subgroup Identification via Constrained Policy Tree Search. Available on *GitHub*.
- **JQL**: Jump Q-Learning for Individualized Interval-Valued Dose Rule. Available on *CRAN*.
- **APtool**: Average Positive Predictive Values (AP) for Binary Outcomes and Censored Event Times. Available on *CRAN*.
- **APRL**: Assets Portfolio Model by Reinforcement Learning. Available on *GitHub*.

PROFESSIONAL ACTIVITIES AND SERVICES

Review Services:

- Conference:
 - The 10th International Conference on Learning Representations (ICLR) 2021
 - The 35th Conference on Neural Information Processing Systems (NeurIPS) 2021
 - The 38th and 39th International Conference on Machine Learning (ICML) 2021, 2022
 - The ‘Causal Inference Challenges in Sequential Decision Making: Bridging Theory and Practice’ Workshop at NeurIPS 2021
 - The 24th International Conference on Artificial Intelligence and Statistics (AISTATS) 2020
- Journal:
 - The Journal of the American Statistical Association
 - The Transactions on Machine Learning Research
 - Stat

Memberships:

- American Statistical Association (ASA) 2017 - Present
- International Chinese Statistical Association (ICSA) 2019 - Present

Invited Events:

- The 4th Annual Women in Research Lean In (Facebook) Menlo Park, CA, 2019
- The Women in Statistics and Data Science Conference Virtual, 2021

Website Manager: 2019 *ICSA Applied Statistics Symposium* Raleigh, NC, 2019

INVITED AND CONTRIBUTED TALKS

- Doubly Robust Interval Estimation for Optimal Policy Evaluation in Online Learning. *The 5th International Conference on Econometrics and Statistics (EcoSta), June 2022, Kyoto, Japan. Invited.*

- Deep Jump Learning for Off-Policy Evaluation in Continuous Treatment Settings. *The 35th Conference on Neural Information Processing Systems (NeurIPS), Dec 2021, Virtual. Invited.*
- Multi-Agent Graph Cooperative Bandits. *NeurIPS-21 Causal Inference Challenges in Sequential Decision Making: Bridging Theory and Practice Workshop, Dec 2021, Virtual. Invited.*
- Doubly Robust Interval Estimation for Optimal Policy Evaluation in Online Learning. *2021 Computational and Methodological Statistics (CMStatistics), Dec 2021, King's College London. Invited.*
- Explainable Causal Graph Learning for Hero Feature Discovery. *Explainable AI Workshop at the 9th Amazon Machine Learning Conference, Oct 2021, Virtual. Invited.*
- Calibrated Optimal Decision Making with Multiple Data Sources and Limited Outcome. *Joint Statistics Meeting (JSM) 2021, Aug 2021, Virtual. Invited.*
- Learning Periodic World with Gaussian Process Bandits. *IJCAI-21 Reinforcement Learning for Intelligent Transportation Systems Workshop, Aug 2021, Virtual. Invited.*
- Analysis of Causal Effects with Multiple Mediators via Constrained Structural Learning. *The 9th International Conference on Learning Representations (ICLR), May 2021, Virtual. Invited.*
- On Optimal Treatment Decision Making by Auxiliary Data with Application to AIDs Study. *The Duke-Industry Statistics Symposium (DISS) 2021, April 2021, Virtual. Invited.*
- Deep Jump Q-Evaluation for Offline Policy Evaluation in Continuous Action Space. *The 2021 ENAR Spring Meeting, March 2021, Virtual. Invited.*
- A Bandit Framework for Dynamic Pricing. *Reinforcement Learning for E-commerce Workshop at the 8th Amazon Machine Learning Conference, Oct 2020, Virtual. Invited.*
- Marketing Experiment Bridging: Time Inverse Bayesian Learning. *The 8th Amazon Machine Learning Conference, Sep 2020, Virtual. Invited.*
- On Validation and Planning of An Optimal Decision Rule with Application in Healthcare Studies. *Joint Statistics Meeting (JSM) 2020, Aug 2020, Virtual. Self Contributed.*
- On Validation and Planning of An Optimal Decision Rule with Application in Healthcare Studies. *The 37th International Conference on Machine Learning (ICML), July 2020, Virtual. Invited.*