HENGRUI CAI

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EDUCATION

North Carolina State University (NCSU), United States *Aug 2017 - May 2022 (Expected)*
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 - Jan 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., 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).*

5. **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.

6. **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).*

7. 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. **Cai, H.***, Shen, Y.*, & 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. *Under review.*

5. **Cai, H.**, Cen, Z., & Song, R. (2021). MAGNET: Multi-Agent Graph Cooperative Bandits. *Under review.*

(* co-first author)

TEACHING

Lab Instructor for Graduate Course

- ST 703: Statistical Methods I (Fall 2019).

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).

I have been nominated for the Outstanding TA Award for my exceptional TA performance and outstanding TA service provided in ST 511 and ST 790 in Fall 2018 and in ST 505 in Fall 2020 at NCSU.

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:

- The 10th International Conference on Learning Representations (ICLR) 2021
- The 35th Conference on Neural Information Processing Systems (NeurIPS) 2021
- The 38th International Conference on Machine Learning (ICML) 2021
- 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

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

- Deep Jump Learning for Off-Policy Evaluation in Continuous Treatment Settings. *The 35th Conference on Neural Information Processing Systems (NeurIPS), 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**.