# HENGRUI CAI

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## EMPLOYMENT

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| **July, 2022 -** | **Assistant Professor** | Department of Statistics, University of California Irvine |

## EDUCATION

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| **May, 2022** | **Ph.D. in Statistics** | North Carolina State University (NCSU) |

Thesis: On Optimal Decision Making and Policy Evaluation with Complex Data
Co-Advisors: Dr. Wenbin Lu and Dr. Rui Song

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| **June, 2017** | **B.S. in Statistics** | Zhejiang University |

Minor: Advanced Honor Class of Engineering Education, Chu Kochen Honors College

## AWARDS AND HONORS

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| **2020** | ENAR Distinguished Student Paper Award, The International Biometric Society |
| **2019, 2020** | Nominated for the Outstanding Teaching Assistant Award, NCSU |
| **2017 -** | Mu Sigma Rho, National Statistics Honor Society, NCSU |
| **2017** | National Undergraduate Research Fund, China |
| **2016** | Meritorious Winner in American Mathematical Contest |

## RESEARCH INTEREST

- Causal Inference and Causal Structure Learning

- Reinforcement / Deep Learning

## PUBLICATIONS

(* co-first author, ___ graduate student)

11. Zhang, W., Wu, T., Wang, Y., Cai, Y., & **Cai, H.** On Causal Rationalization. In *NeurIPS 2022 Workshop on Causality for Real-world Impact.*

10. **Cai, H.**, Lu, W., Marceau West R., Mehrotra DV., & Huang, L. (2022). CAPITAL: Optimal Subgroup Identification via Constrained Policy Tree Search. *Statistics in Medicine.* 2022;1-14. DOI:10.1002/sim.9507.

9. Gates, T.A., **Cai, H.**, Hu, Y., Han, X., Griffith, E., Burgener, L., Hyland, E. & Zanno, L.E. (2022). Estimating ancient biogeographic patterns with statistical model discrimination. *The Anatomical Record.*

8. **Cai, H.**\*, Shi, C.\*, Song, R., & Lu, W. (2021). Deep Jump Learning for Off-Policy Evaluation in Continuous Treatment Settings. *Advances in Neural Information Processing Systems, 34,* 15285-15300. [**Distinguished Student Paper Awards for the 2021 ENAR Spring Meeting.**]

7. **Cai, H.**, Song, R., & Lu, W. (2021). ANOCE: Analysis of Causal Effects with Multiple Mediators via Constrained Structural Learning. In *International Conference on Learning Representations.*

6. **Cai, H.**, Song, R., & Lu, W. (2021). GEAR: On Optimal Decision Making with Auxiliary Data. *Stat,* 10(1):e399.

5. **Cai, H.**, Cen, Z., & Song, R. (2021). MAGNET: Multi-Agent Graph Cooperative Bandits. In *NeurIPS-21 Causal Inference Challenges in Sequential Decision Making: Bridging Theory and Practice Workshop (Oral).*

4. **Cai, H.**, Cen, Z., Leng, L., & Song, R. (2021). Periodic-GP: Learning Periodic World with Gaussian Process Bandits. In *IJCAI-21 Reinforcement Learning for Intelligent Transportation Systems Workshop (Spotlight).*

3. **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* (pp. 1262-1270). PMLR.

2. **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).*

1. 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

7. **Cai, H.**, Wang, Y., Jordan, M., & Song, R. (2023+). On Learning Necessary and Sufficient Causal Graphs. *arXiv preprint arXiv:2301.12389.*

6. **Cai, H.**, Lu, W., & Song, R. (2023+). CODA: Calibrated Optimal Decision Making with Multiple Data Sources and Limited Outcome. *arXiv preprint arXiv:2104.10554.*

5. **Cai, H.**\*, Shi, C.\*, Song, R., & Lu, W. (2023+). Jump Q-Learning for Individualized Decision Making with Continuous Treatments. *arXiv preprint arXiv:2111.08885.*

4. Shen, Y.\*, **Cai, H.**\*, & Song, R. (2023+). Doubly Robust Interval Estimation for Optimal Policy Evaluation in Online Learning. *arXiv preprint arXiv:2110.15501.* [**Institute of Mathematical Statistics Hannan Graduate Student Travel Award 2022.**]

3. Watson, RA., **Cai, H.**, An, X., McLean, S., & Song, R. (2023+). On Heterogeneous Treatment Effects in Heterogeneous Causal Graphs. *arXiv preprint arXiv:2301.12383.* [**JSM 2023 Mental Health Statistics Section Student Paper Award.**]

2. Shen, Y., Wan, R., **Cai, H.**, & Song, R. (2023+). Heterogeneous Synthetic Learner for Panel Data. *arXiv preprint arXiv:2212.14580.*

1. Price, K.+, **Cai, H.**, Shen, W., Hu, G. (2023+). How much does Home Field Advantage matter in Soccer Games? A causal inference approach for English Premier League analysis. *arXiv preprint arXiv:2205.07193.*

## PRESENTATIONS

- Towards Trustworthy Explanation: On Causal Rationalization. *Reinforcement Learning + X Seminar.* **Invited**. Feb 2023, Virtual

- Towards Explainable Causal Revolution: On Causal Relation, Impact, and Policy Learning. *BrownBag Seminar, University of California Irvine.* **Invited**. Jan 2023, Irvine

- Towards Explainable Causal Revolution: Causal Rationalization. *Capital of Statistics.* **Invited**. Dec 2022, Virtual

- Towards Explainable Causal Revolution: Analysis of Causal Effects. *University of California Riverside.* **Invited**. Nov 2022, Riverside

- On Optimal Decision Making and Policy Evaluation with Complex Data. *Children's Hospital of Orange County.* **Invited**.                                                          Oct 2022, Irvine

- Towards Explainable Causal Revolution: Analysis of Causal Effects. *University of California Santa Barbara.* **Invited**.                                          Oct 2022, Santa Barbara

- Optimal Subgroup Identification via Constrained Policy Tree Search. *Children's Hospital of Orange County.* **Invited**.                                                      Sep 2022, Irvine

- Calibrated Optimal Decision Making with Multiple Data Sources and Limited Outcome. *Joint Statistics Meeting (JSM) 2022.* **Invited**.                          Aug 2022, Washington, D.C.

- Doubly Robust Interval Estimation for Optimal Policy Evaluation in Online Learning. *From Statistics to Artificial Intelligence-Reinforcement Learning.* **Invited**.          July 2022, Virtual.

- Doubly Robust Interval Estimation for Optimal Policy Evaluation in Online Learning. *The SSC 2022 Annual Meeting.* **Invited**.                                              June 2022, Virtual

- Calibrated Optimal Decision Making with Multiple Data Sources and Limited Outcome. *The 2022 ICSA Applied Statistics Symposium.* **Invited**.                          June 2022, Gainesville

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

- Deep Jump Learning for Off-Policy Evaluation in Continuous Treatment Settings. *The 35th Conference on Neural Information Processing Systems (NeurIPS).* **Invited**.          Dec 2021, Virtual

- Multi-Agent Graph Cooperative Bandits. *NeurIPS-21 Causal Inference Challenges in Sequential Decision Making: Bridging Theory and Practice Workshop.* **Invited**.          Dec 2021, Virtual

- Doubly Robust Interval Estimation for Optimal Policy Evaluation in Online Learning. *2021 Computational and Methodological Statistics (CMStatistics).* **Invited**.          Dec 2021, Virtual

- Explainable Causal Graph Learning for Hero Feature Discovery. *Explainable AI Workshop at the 9th Amazon Machine Learning Conference.* **Invited**.                          Oct 2021, Virtual

- Calibrated Optimal Decision Making with Multiple Data Sources and Limited Outcome. *Joint Statistics Meeting (JSM) 2021.* **Invited**.                                      Aug 2021, Virtual

- Learning Periodic World with Gaussian Process Bandits. *IJCAI-21 Reinforcement Learning for Intelligent Transportation Systems Workshop.* **Invited**.                      Aug 2021, Virtual

- Analysis of Causal Effects with Multiple Mediators via Constrained Structural Learning. *The 9th International Conference on Learning Representations (ICLR).* **Invited**.      May 2021, Virtual

- On Optimal Treatment Decision Making by Auxiliary Data with Application to AIDs Study. *The Duke-Industry Statistics Symposium (DISS) 2021.* **Invited**.                    April 2021, Virtual

- Deep Jump Q-Evaluation for Offline Policy Evaluation in Continuous Action Space. *The 2021 ENAR Spring Meeting.* **Invited**.                                              March 2021, Virtual

- A Bandit Framework for Dynamic Pricing. *Reinforcement Learning for E-commerce Workshop at the 8th Amazon Machine Learning Conference.* **Invited**.                          Oct 2020, Virtual

- Marketing Experiment Bridging: Time Inverse Bayesian Learning. *The 8th Amazon Machine Learning Conference.* **Invited**.                                                  Sep 2020, Virtual

- On Validation and Planning of An Optimal Decision Rule with Application in Healthcare Studies. *Joint Statistics Meeting (JSM) 2020.* **Self Contributed**.                  Aug 2020, Virtual

- On Validation and Planning of An Optimal Decision Rule with Application in Healthcare Studies. *The 37th International Conference on Machine Learning (ICML).* **Invited**.    July 2020, Virtual

## TEACHING & ADVISING EXPERIENCE

### University of California Irvine (2022-)

- **Instructor:**
  - STATS 120C/281C: Introduction to Probability and Statistics III (Spring 2023). Two sections, >150 students

- **Advising Students:**
  - Wenbo Zhang (Ph.D. Student)                                      Expect to graduate in 2025
  - Shih Ting Huang (Master Student)                                 Expect to graduate in 2023
  - Louis Chu (Undergraduate Student)                                Expect to graduate in 2024

- **Committee Member:**
  - Roy Zawadzki
  - Hanwen Ye

### North Carolina State University (Prior to 2022)

- **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/Undergraduate Courses**
  - ST 422: Introduction to Mathematical Statistics II (Fall 2021)
  - ST 745: Analysis of Survival Data (Spring 2021)
  - ST 405/505: Applied Nonparametric Statistics (Fall 2020)
  - ST 311: Introduction to Statistics (Spring 2019)
  - ST 790: Financial Statistics (Fall 2018)
  - ST 312: Introduction to Statistics II (Spring 2018)
  - ST 511: Introduction to Statistics for Biological Sciences (Fall 2018)
  - ST 350: Economic and Business Statistics (Fall 2017)

## PROFESSIONAL ACTIVITIES AND SERVICES

### Department Services:

- Graduate Admissions Committee, Department of Statistics, University of California Irvine   2023
- Statistics Seminar, Department of Statistics, University of California Irvine                Fall 2023

### Review Services:

- Conference:
  - The 38th, 39th, 40th International Conference on Machine Learning (ICML)        2021-2023
  - The 35th, 36th Conference on Neural Information Processing Systems (NeurIPS)  2021-2022
  - The 10th, 11th International Conference on Learning Representations (ICLR)       2021-2022
  - The 24th International Conference on Artificial Intelligence and Statistics (AISTATS)   2020

- Journal:
  - The Journal of the American Statistical Association
  - The Journal of the Royal Statistical Society Series B
  - Biometrika
  - Annals of Statistics
  - The Journal of Machine Learning Research
  - Biometrics
  - Journal of Nonparametric Statistics
  - Stat
  - The Transactions on Machine Learning Research

**Professional Services:**

- Student Paper Award Committee for Statistical Learning and Data Science (SLDS) of the American Statistical Association (ASA)　　　　　　　　　　　2023

- Program Committee (PC) Member for Workshops:
  - The 'Trustworthy and Socially Responsible Machine Learning' Workshop at NeurIPS　　2022
  - The 'Causal Inference Challenges in Sequential Decision Making: Bridging Theory and Practice' Workshop at NeurIPS　　　　　　　　　　　2021

**Professional Memberships**

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