CompSci 295 - Causal Reasoning, Winter 2023
Project Information

Projects can be done by individual students or by groups of 2 students. Each student (or a pair of students) will be presenting topics of Causal Reasoning to the class. There are three general sources from which you will choose topics to present:

1. [ACM] 2022 ACM book in honor of Judea Pearl.
2. [LRS] Papers from leading researchers websites
3. [UAI] Select research papers from UAI 2022 UAI 2021 and UAI 2020.
4. Database of potential causal relevant application papers

(Further below, you will find a specific list of topics you can select from).

Choose three allowed topics (see below) from the sources above to propose presenting to the class. Rank your choices in preference (with 1 being your most preferred topic). At least one of your selected topics must be from [ACM]. At most one can be from the UAI 2021 and 2022. One paper should be an application paper. For any choice from the ACM book which is not available (google search), email me and I will provide you with the chapter. You can also select a paper not in the lists above as a 3rd choice. Record your choices on the Project Sign-Up Sheet (filling in all appropriate fields).

Topics To Select From

[CLS] Class textbooks and provided slides.

1. Causal Discovery
2. Counterfactuals

[ACM] A forthcoming ACM book on Judea Pearl.

(Note that if any of these are not individually accessible, I will supply you with the chapter).

1. Causality 1988–2001

a. Equivalence and Synthesis of Causal Models (1991), with T. Verma (223)

b. Probabilistic Evaluation of Counterfactual Queries (1994), with A. Balke

c. Direct and Indirect Effects (2001) (353)

2. Causality 2002–2020 (365)
(377)

a. Recovering from Selection Bias in Causal and Statistical Inference (2014), with E. Bareinboim and J. Tian (391)

b. External validity: From do-calculus to transportability across populations (2014), Pearl and E. Bareinboim (399)

c. Detecting Latent Heterogeneity (2015) (417)

3. Causal Casual and Curious: Selected Pieces (2013–2020) (443)
(449)
(513)

a. Instrumental Variables with Treatment-Induced Selection: Ex- act Bias Results. Felix Elwert, Elan Segarra (531)
(627)

b. Causal Models for Dynamic Systems. Jonas Peters. Stefan Bauer. Niklas Pfister (631)
(695)

c. Causal Graphical Models And Multivariate Counterfactual Systems. Ilya Shpitser, Thomas S. Richardson, and James M. Robins (705)

[LRS] Some Recent Papers from Leading Researchers.

Y. Jung, **J. Tian, and E. Bareinboim**, Double Machine Learning Density Estimation for Local Treatment Effects with Instruments. In *Proceedings of the 35th Annual Conference on Neural Information Processing Systems (NeurIPS),* 2021. To appear.

- Y. Jung, J. Tian, and E. Bareinboim, Estimating Identifiable Causal Effects through Double Machine Learning. In *Proceedings of the 35th AAAI Conference on Artificial Intelligence (AAAI)*, 2021.
- Hebi Li, Qi Xiao, and Jin Tian, Supervised Whole DAG Causal Discovery. arXiv:2006.04697, 2020.
- Y. Jung, J. Tian, and E. Bareinboim, Learning Causal Effects via Weighted Empirical Risk Minimization. In *Proceedings of the 34th Annual Conference on Neural Information Processing Systems (NeurIPS),* 2020.
- Y. Jung, J. Tian, and E. Bareinboim, Estimating Causal Effects Using Weighting-Based Estimators. In *Proceedings of the 34th AAAI Conference on Artificial Intelligence (AAAI),* 2020.
- Karthika Mohan
- Peter Spirtes

Additional selected papers

Causal Inference Through the Structural Causal Marginal Problem by Luigi Gresele * 1 Julius von K¨ugelgen * 1 2 Jonas M. K¨ubler * 1 Elke Kirschbaum 3 Bernhard Sch¨olkopf 1 Dominik Janzing (PLMR)

Graphical Models of Pandemic, by Michael Chertkov,1, 2, 3, 4, 5, Ruby Abrams,1, 2, y Amir Mohammad Esmaieeli Sikaroudi,6, z Mikhail, Krechetov,7, x CNP Slagle,3, 2, { Alon Efrat,4, 1, Radoslav Fulek,8, yy and Eyal Oren9, zz

Interventional Sum-Product Networks: Causal Inference with Tractable Probabilistic Models by Matej Ze˘cevi´c1 Devendra Singh Dhami1 Athresh Karanam2 Sriraam Natarajan2 Kristian Kersting1

Potential Applications

here

and here

[UAI] Select research papers from UAI 2022.

Ordinal Causal Discovery

\Yang Ni (Texas A&M); Bani Mallick (Texas A&M)

Causal Discovery under a Confounder Blanket

David Watson (University College London); Ricardo Silva (University College London)

A Causal Bandit Approach to Learning Good Atomic Interventions in Presence of Unobserved Confounders [ok]

Aurghya Maiti (Adobe Systems); Vineet Nair (Google Research India); Gaurav Sinha (California Institute of Technology)

Causal Discovery of Extended Summary Graphs in Time Series

Charles K. Assaad (EasyVista); Emilie Devijver (CNRS); Eric Gaussier (University Grenoble Alpes)

On the Definition and Computation of Causal Treewidth

Yizuo Chen (University of California, Los Angeles); Adnan Darwiche (University of California, Los Angeles)

Causal Inference with Treatment Measurement Error: A Nonparametric Instrumental Variable Approach

Yuchen Zhu (University College London); Limor Gultchin (University of Oxford); Arthur Gretton (University College London); Matt Kusner (University College London); Ricardo Silva (University College London)

Robust Identifiability in Linear Structural Equation Models of Causal Inference

Karthik Abinav Sankararaman (Facebook); Anand Louis (Indian Institute of Science); Navin Goyal (Microsoft)

Identifiability of Sparse Causal Effects using Instrumental Variables

Niklas Pfister (University of Copenhagen); Jonas Peters (University of Copenhagen)

[UAI] Select research papers from UAI 2021. (https://researchr.org/publication/uai-2021**)**

1. Takeshi Teshima, Masashi Sugiyama. ***Incorporating causal graphical prior knowledge into predictive modeling via simple data augmentation*** [pdf] [sup] [doi]
2. Takashi Nicholas Maeda, Shohei Shimizu. ***Causal additive models with unobserved variables*** [pdf] [doi]
3. Eigil F. Rischel, Sebastian Weichwald. ***Compositional abstraction error and a category of causal models*** [pdf] [sup] [doi]
4. David Strieder, Tobias Freidling, Stefan Haffner, Mathias Drton. ***Confidence in causal discovery with linear causal models*** [pdf] [doi]
5. Marcel Wienöbst, Max Bannach, Maciej Liśkiewicz. ***Extendability of causal graphical models: Algorithms and computational complexity*** [pdf] [sup] [doi]
6. Ludvig Hult, Dave Zachariah. ***Inference of causal effects when control variables are unknown*** [pdf] [sup] [doi]
7. Sofia Triantafillou, Fattaneh Jabbari, Gregory F. Cooper. ***Causal and interventional Markov boundaries*** [pdf] [sup] [doi]
8. Philip A. Boeken, Joris M. Mooij. ***A Bayesian nonparametric conditional two-sample test with an application to Local Causal Discovery*** [pdf] [sup] [doi]
9. Spencer L. Gordon, Vinayak M. Kumar, Leonard J. Schulman, Piyush Srivastava. ***Condition number bounds for causal inference*** [pdf] [sup] [doi]
10. Abhinav Kumar, Gaurav Sinha. ***Disentangling mixtures of unknown causal interventions*** [pdf] [sup] [doi]
11. Noam Finkelstein, Roy Adams, Suchi Saria, Ilya Shpitser. ***Partial Identifiability in Discrete Data with Measurement Error*** [pdf] [sup] [script] [doi]

[UAI] Select research papers from UAI 2020. (http://www.auai.org/uai2020/accepted.php**)**

1. Julius von Kügelgen, Alexander Mey, Marco Loog, Bernhard Schölkopf, ***Semi-supervised learning, causality, and the conditional cluster assumption***

2. Yue Wang, Shaofeng Zou, ***Finite-sample Analysis of Greedy-GQ with Linear Function Approximation under Markovian Noise***

3. Marco Eigenmann, Sach Mukherjee, Marloes Maathuis, ***Evaluation of Causal Structure Learning Algorithms via Risk Estimation***

4. Yue Liu, Zhuangyan Fang, Yangbo He, Zhi Geng, ***Collapsible IDA: Collapsing Parental Sets for Locally Estimating Possible Causal Effects***

5. Sorawit Saengkyongam, Ricardo Silva, Le***arning Joint Nonlinear Effects from Single-variable Interventions in the Presence of Hidden Confounders***

6. Søren Wengel Mogensen, ***Causal screening in dynamical systems***

7. Diego Agudelo-España, Sebastian Gomez-Gonzalez, Stefan Bauer, Bernhard Schölkopf, Jan Peters, ***Bayesian Online Prediction of Change Points***

8. Emilija Perkovic, ***Identifying causal effects in maximally oriented partially directed acyclic graphs***

9. Zhiqiang Xu, Ping Li, ***A Practical Riemannian Algorithm for Computing Dominant Generalized Eigenspace***

10. Numair Sani, Jaron Lee, Ilya Shpitser, ***Identification and Estimation of Causal Effects Defined by Shift Interventions***

11. Carlos Amendola, Philipp Dettling, Mathias Drton, Federica Onori, Jun Wu, ***Structure Learning for Cyclic Linear Causal Models***

12. Chandler Squires, Yuhao Wang, Caroline Uhler, ***Permutation-Based Causal Structure Learning with Unknown Intervention Targets***

13. Mohammad Ali Javidian, Marco Valtorta, Pooyan Jamshidi, ***Learning LWF Chain Graphs: A Markov Blanket Discovery Approach***

14. Joris M. Mooij, Tom Claassen, ***Constraint-Based Causal Discovery using Partial Ancestral Graphs in the presence of Cycles***

15. Jan-Christian Huetter, Philippe Rigollet, ***Estimation Rates for Sparse Linear Cyclic Causal Models***

16. Tárik Saleh Salem, Helge Langseth, Heri Ramampiaro, ***Prediction Intervals: Split Normal Mixture from Quality-Driven Deep Ensembles***

17. Noam Finkelstein, Ilya Shpitser, ***Deriving Bounds And Inequality Constraints Using Logical Relations Among Counterfactuals***