Murat Kocaoglu

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West Lafayette, IN 47907

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Current Position

Assistant Professor Jan. 1, 2021 – present

School of Electrical and Computer Engineering
Purdue University
I conduct research on causal machine learning, causal structure discovery, deep generative models and information theory.

Teaching Experience

Instructor Fall 2022, Fall 2023

ECE695-230: Probabilistic Causal Inference
School of Electrical and Computer Engineering, Purdue University
Causal inference and discovery, ML applications.
Fall 2021 Enrollment: 15 students. Fall 2023 Enrollment: 20 students

Instructor Spring 2022, Spring 2023, Spring 2024

ECE20875: Python for Data Science
School of Electrical and Computer Engineering, Purdue University
Basics of data science and statistics, and Python.
Spring 2022 Enrollment: 132 students. Spring 2023 Enrollment: 90 students.
Spring 2024 Enrollment: 139 students.

Instructor Fall 2022

ECE642: Information Theory and Source Coding
School of Electrical and Computer Engineering, Purdue University
Encoding/decoding and transmission of information. Entropy, channel capacity, and source compression algorithms. Enrollment: 15.

Co-Instructor Spring 2021

ECE302: Probabilistic Methods in Electrical and Computer Eng.
School of Electrical and Computer Engineering, Purdue University
Co-taught with Prof. Saul Gelfand. Enrollment: 261 students.

Education

The University of Texas at Austin, Sept. 2013 – Aug. 2018
PhD, Electrical and Computer Engineering.
Thesis: Causality: From Learning to Generative Models
Co-advisor: *Prof. Alexandros Dimakis*
Co-advisor: *Prof. Sriram Vishwanath*

Koc University, Istanbul, Turkey Sept. 2010 – Aug. 2012
Master of Science, Electrical Engineering.
Thesis: Minimum Energy Channel and Network Coding with Applications in Nanoscale Communications
Advisor: *Prof. Ozgur B. Akan*

Middle East Technical University, Ankara, Turkey Sept. 2006 – Jun. 2010
Major: Bachelor of Science, Electrical and Electronics Engineering.
Graduated with High-honors
Minor: Physics

Prev. Positions

Research Staff Member, MIT-IBM Watson AI Lab, IBM Research MA, USA — Sept. 2018 – Dec. 2020
I conducted research on causal inference and discovery, learning theory, deep generative models and information theory.

Research Assistant, Wireless Networking and Communications Group, The University of Texas at Austin, Austin. USA. — Sept. 2013 – Aug. 2018
I conducted research on causal discovery from observational data using information-theoretic methods, as well as causal discovery using interventions. I also worked on learning theory and online algorithms.

Current Research Interests

- Causal Machine Learning
- Fundamentals of Causal Inference and Causal Discovery
- Deep Generative Models
- Information Theory

Post-Doc Researchers

Lai Wei — Fall 2022 - Summer 2023

PhD Students

Md. Musfiqur Rahman	Fall 2021 - current
Kenneth Lee	Fall 2021 - current
Ziwei Jiang	Fall 2022 - current
Shanyun Gao	Fall 2022 - current
Qasim Elahi	Fall 2022 - current
Zihan Zhou	Fall 2023 - current

Visiting Researchers

Suyeong Park — July - August 2021

Publications
Machine Learning, AI

1. S. Kulinski, Z. Zhou, R. Bai, M. Kocaoglu, D. I. Inouye, "Towards Characterizing Domain Counterfactuals for Invertible Latent Causal Models", in **Prof. of ICLR'24**, 2024.
2. M. Kocaoglu, "Characterization and Learning of Causal Graphs with Small Conditioning Sets", in **Proc. of NeurIPS'23**, New Orleans, LA, USA, 2023.
3. S. Gao, R. Addanki, T. Yu, R. A. Rossi, M. Kocaoglu, "Causal Discovery in Semi-Stationary Time Series," in **Proc. of NeurIPS'23**, New Orleans, LA, USA, 2023.
4. L. Wei, M. Q. Elahi, M. Ghasemi, M. Kocaoglu, "Approximate Allocation Matching for Structural Causal Bandits with Unobserved Confounders," in **Proc. of NeurIPS'23**, New Orleans, LA, USA, 2023.
5. A. Shah, K. Shanmugam, M. Kocaoglu, "Front-door Adjustment Beyond Markov Equivalence with Limited Graph Knowledge", in **Proc. of NeurIPS'23**, New Orleans, LA, USA, 2023.
6. K, Lee, M. Rahman, M. Kocaoglu, "Finding Invariant Predictors Efficiently via Causal Structure", in **Proc. of UAI'23**, Pittsburgh, Mar. 2023.
7. Z. Jiang, L. Wei, M. Kocaoglu, "Approximate Causal Effect Identification under Weak Confounding", in **Proc. of ICML'23**, Feb. 2023.
8. S. Compton, D. Katz, B. Qi, K. Greenewald, M. Kocaoglu, "Minimum-Entropy Coupling Approximation Guarantees Beyond the Majorization Barrier," in **Proc. of AISTATS'23**, Valencia, Spain, Apr. 2023.
9. M. A. Ikram, S. Chakraborty, S. Mitra, S. Saini, S. Bagchi, M. Kocaoglu, "Root Cause Analysis of Failures in Microservices through Causal Discovery," in **Proc. of NeurIPS'22**, Dec. 2022.
10. S. Compton, K. Greenewald, D. Katz, M. Kocaoglu, "Entropic Causal Inference: Graph Identifiability", in **Proc. of ICML'22**, Baltimore, USA, July 2022.

11. K. Ahuja, P. Sattigeri, K. Shanmugam, D. Wei, K. N. Ramamurthy, M. Kocaoglu, "Conditionally Independent Data Generation", in **Proc. of UAI'21**, Online, July 2021.
12. M. Kocaoglu, S. Shakkottai, A. G. Dimakis, C. Caramanis, S. Vishwanath, "Applications of Common Entropy for Causal Inference," in **Proc. of NeurIPS'20**, Online, Dec. 2020.
13. S. Compton, M. Kocaoglu, K. Greenewald, D. Katz, "Entropic Causality: Identifiability and Finite Sample Results," in **Proc. of NeurIPS'20**, Online, Dec. 2020.
14. A. Jaber, M. Kocaoglu, K. Shanmugam, E. Bareinboim, "Causal Discovery from Soft Interventions with Unknown Targets: Characterization and Learning," in **Proc. of NeurIPS'20**, Online, Dec. 2020.
15. C. Squires, S. Magliacane, K. Greenewald, D. Katz, M. Kocaoglu, K. Shanmugam, "Active Structure Learning of Causal DAGs via Directed Clique Trees," in **Proc. of NeurIPS'20**, Online, Dec. 2020.
16. M. Kocaoglu*, A. Jaber*, K. Shanmugam*, E. Bareinboim, "Characterization and Learning of Causal Graphs with Latent Variables from Soft Interventions," in **Proc. of NeurIPS'19**, Vancouver, Canada, Dec. 2019.
17. K. Greenewald, D. Katz, K. Shanmugam, S. Magliacane, M. Kocaoglu, E. B. Adsera, G. Bresler, "Sample Efficient Active Learning of Causal Trees," in **Proc. of NeurIPS'19**, Vancouver, Canada, Dec. 2019.
18. E. Lindgren, M. Kocaoglu, A. G. Dimakis, S. Vishwanath, "Minimum Cost Intervention Design and Connections to Submodularity," in **Proc. of NeurIPS'18**, Montreal, Canada, Dec. 2018.
19. M. Kocaoglu*, C. Snyder*, A. G. Dimakis, S.Vishwanath, "CausalGAN: Learning Causal Implicit Generative Models with Adversarial Training," in **Proc. of ICLR'18**, Vancouver, May 2018.
20. M. Kocaoglu*, K. Shanmugam*, E. Bareinboim, "Experimental Design for Learning Causal Graphs with Latent Variables," in **Proc. of NIPS'17**, Dec. 2017.
21. M. Kocaoglu, A. G. Dimakis, S. Vishwanath, "Cost-Optimal Learning of Causal Graphs," in **Proc. of ICML'17**, 2017.
22. M. Kocaoglu, A. G. Dimakis, S. Vishwanath, B. Hassibi, "Entropic Causality and Greedy Minimum Entropy Coupling," in **Proc. of ISIT'17**, 2017.
23. R. Sen, K. Shanmugam, M. Kocaoglu, A. G. Dimakis, S. Shakkottai, "Contextual Bandits with Latent Confounders: An NMF Approach," in **Proc. of AISTATS'17**, Fort Lauderdale, USA, Apr. 2017.
24. M. Kocaoglu, A. G. Dimakis, S. Vishwanath, B. Hassibi, "Entropic Causal Inference," in **Proc. of AAAI'17**, San Francisco, USA, Feb. 2017.
25. K. Shanmugam*, M. Kocaoglu*, A. G. Dimakis, S. Vishwanath, "Learning Causal Graphs with Small Interventions," in **Proc. of NIPS'15**, Montreal, Canada, Dec. 2015.
26. M. Kocaoglu*, K. Shanmugam*, A. G. Dimakis, A. Klivans, "Sparse Polynomial Learning and Graph Sketching," in **Proc. of NIPS'14 (Oral)**, Montreal, Canada, Dec. 2014.

Workshop Papers

1. S. Gao, R. Addanki, T. Yu, R. A. Rossi, M. Kocaoglu, "Causal Discovery in Semi-Stationary Time Series," UAI 2023 Workshop on Causal inference for Time-series Data, 2023.
2. Z. Jiang, L. Wei, M. Kocaoglu, "Approximate Causal Effect Identification under Weak Confounding," ICML 2023 Workshop on Spurious Correlations, Invariance, and Stability, 2023.
3. A. Shah, K. Shanmugam, M. Kocaoglu, "Front-door Adjustment Beyond Markov Equivalence with Limited Graph Knowledge," ICML 2023 Workshop on Spurious Correlations, Invariance, and Stability, 2023.
4. M. Rahman, M. Kocaoglu, "Towards Modular Learning of Deep Causal Generative Models," ICML 2023 Workshop on Spurious Correlations, Invariance, and Stability, 2023.
5. M. Rahman, M. Kocaoglu, "Towards Modular Learning of Deep Causal Generative Models," ICML 2023 Workshop on Structured Probabilistic Inference & Generative Modeling, 2023

6. S. Compton, M. Kocaoglu, K. Greenewald, D. Katz, "Entropic Causal Inference: Identifiability for Trees and Complete Graphs", in ITR3 Workshop at ICML-21, Online, July 2021.
7. E. Lindgren, M. Kocaoglu, A. G. Dimakis, S. Vishwanath, "Submodularity and Minimum Cost Intervention Design for Learning Causal Graphs," in DISCML'17 Workshop, NIPS'17, Dec. 2017.
8. M. Kocaoglu, A. G. Dimakis, S. Vishwanath, "Learning Causal Graphs with Constraints," in NIPS'16 Workshop: What If? Inference and Learning of Hypothetical and Counterfactual Interventions in Complex Systems, Barcelona, Spain, Dec. 2016.

Invited Talks & Activities

Invited Participant for "Semiconductor Industry Roundtable on Open and Scaled Data Sharing for Smart Manufacturing", Minneapolis, Feb. 2024.

Invited Talk on "Approximate Causal Effect Identification under Weak Confounding", Information Theory Applications Workshop (ITA), San Diego, CA, Feb. 2024.

Invited Talk on "Causal Discovery via Common Entropy" at the Causal Inference & Quantum Foundations Workshop, Perimeter Institute, Waterloo, ON, Canada, Apr. 2023.

Invited Talk on "Entropic Causal Inference and Approximate Minimum Entropy Coupling", Information Theory Applications Workshop (ITA), San Diego, CA, Feb. 2023.

TILOS Seminar Series Invited Talk on "Causal Discovery for Root-cause Analysis," [Online], Jan. 2023.

Guest Editor for the Special Issue on "Information-theoretic Methods for Causal Inference and Discovery", Entropy, MDPI, 2023.

ICON Seminar on "Causal Discovery for Root-cause Analysis", Purdue University, October 2022.

Pacific Northwest National Laboratory (PNNL) Research Seminar on "Causal Discovery for Root-cause Analysis", July 2022.

Invited Participant at Simons Institute Causality Workshop, UC Berkeley, February 2022.

General chair for The AAAI-22 Workshop on Information-Theoretic Methods for Causal Inference and Discovery (ITCI'22), Vancouver, Canada, February 2022.

Session Chair for ICERM Workshop on Advances in Theory and Algorithms for Deep Reinforcement Learning, [Online], Aug. 2, 2021.

Discussant in Causality Session at UAI'21 [Online], July 27, 2021.

Purdue ECE Talk: Entropic Methods for Causal Discovery, Online talk for graduate students and the faculty, Mar. 4, 2021.

Session chair for IJCAI'20 [Machine Learning] Learning Generative Models, Jan. 2021.

Lightning Talk in Young Researchers Workshop on CausalGAN, ORIE, Cornell University, Ithaca, NY, Oct. 2019.

Co-organized "Bridging Causal Inference, Reinforcement Learning and Transfer Learning Workshop" in IBM AI Research Week, 2019.

Invited Talk in AAAI-WHY19 Spring Symposium on CausalGAN, Stanford, CA, March 25-27, 2019.

Shannon Channel Talk: Entropic Methods for Causal Discovery, Online talk hosted by Salim El Rouayheb, Mar. 1st, 2019.

Hands-on machine learning workshop (jointly with Alex Dimakis), 2018 North American School of Information Theory, Texas A&M University, May 20-23, 2018.

Invited Talk in Los Alamos National Laboratories (LANL) on Causality, Los Alamos, NM, Aug. 2017.

Organized student seminar series in machine learning in WNCG, UT Austin, 2015-2016.

Organizing Committee

Publicity Chair, UAI 2024

Area Chair, Senior PC, Meta-reviewer For

NeurIPS (since 2023),
AAAI (since 2021),
ICLR (since 2023),
AISTATS (since 2023),
UAI (since 2023),
ACML (since 2022),
IJCAI (2020-2021).

Reviewer For

NeurIPS (2016 - 2022), ICML (since 2018), ICLR, AAAI (2020), AISTATS (2019-2022), IJCAI (2019), UAI, COLT, ISIT, CLeaR (since 2021) and many others.
Journal of Machine Learning Research (JMLR), IEEE Transactions on Information Theory, IEEE Journal on Selected Areas in Information Theory (JSAIT), Neural Networks (ACM), Annals of Statistics, Artificial Intelligence (Elsevier).

PhD/MS Advisory Committee Member

Zeyu Zhou (PhD)
Advisor: David Inouye

Jimmy Ian Gammell
Advisor: Kaushik Roy

Sean Kulinsky (PhD) *Dec. 2023*
Advisor: David Inouye

William Stephen Richards (MS Degree) *2023*
Advisor: Stylianos Chatzidakis

Teng-Hui Huang (PhD Candidate) *2022*
Advisor: Aly El Gamal

Antesh Antesh (MS Candidate)
Advisor: Abolfazl Hashemi

Awards & Recognitions

NSF CAREER Award *July 2023*

Adobe Data Science Research Award *Mar. 2022*

Reviewer Award for NeurIPS 2022 *Nov. 2022*
Top Reviewer

Reviewer Award for UAI 2022 *July 2022*
Top Reviewer

Reviewer Award for ICLR 2022 *April 2022*
Highlighted Reviewer

Program Committee Board Member of IJCAI *2022-2024*

Reviewer Award for UAI 2021 *May 2021*
Amongst Top 5% of Reviewers

Reviewer Award for ICLR 2021 *Mar. 2021*
Outstanding Reviewer

Reviewer Award for ICML 2020 *Sept. 2020*
Amongst Top 33% of Reviewers

Reviewer Award for NeurIPS 2019 *Sept. 2019*
Amongst Top 50% of Reviewers

Reviewer Award for NeurIPS 2018 *Sept. 2018*
Amongst Top 218 Reviewers

Student Travel Award for ICLR 2018 *Mar. 2018*

Student Travel Award for NIPS 2017 *Oct. 2017*

Student Travel Award for ICML 2017 *June 2017*

Student Travel Grant for ISIT 2017 *Apr. 2017*

Short Course Travel Support *May. 2016*
Center for Causal Discovery (CCD), Pittsburgh

Student Travel Award for NIPS 2015 *Oct. 2015*

Best Senior Design Project, Dept. of Electrical and Electronics Engineering *Spring, 2010*
Middle East Technical University, Ankara, Turkey.
A wireless helmet design to detect user's head movements and facial gestures to accomplish certain tasks on the computer.

Bulent Kerim Altay Award, Dept. of Electrical and Electronics Engineering. *Spring, 2009*
Middle East Technical University, Ankara, Turkey.
Ranked 1st in the Department of Electrical and Electronics Engineering

Ranked Top 100 in National University Selection Exam of Turkey, *Jun. 2006*
Among more than 1.5 million students nation-wide

Outreach

Introduce A Girl to Engineering Day Activity Feb. 2023
Lemonade Stand: A hands-on activity that introduced the notion of causality to high school students.

Engineering Academic Career Club Academic Mentor Summer 2021, 2022, 2023
Biweekly mentorship meetings with 8 *students interested in an academic career from a wide range of demographics, including several URM students.*

Mentorship Session *2022*
The AAAI-22 Workshop on Information-theoretic Causal Inference and Discovery

Mentorship Circles at ICLR'21 [Online], March 3, 2021.

Teaching Assistant	**Teaching Assistant**, Dept. of Electrical and Computer Engineering, The University of Texas at Austin *EE313: Linear Systems and Signals, Problem solving and review sessions, homework grading, office hours.*	2013 – 2014
	Teaching Assistant, Dept. of Electrical and Computer Engineering, Koc University, Istanbul, Turkey. *ELEC513: Information Theory, ELEC201: Signals and Systems, ELEC100: Introduction to Electrical and Electronics Engineering, COMP110: Introduction to Programming with MATLAB.*	2013 – 2014
Society Member	IEEE, Member	
	IEEE Information Theory Society, Member	