

BURAK VARICI

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CURRENT POSITION	Carnegie Mellon University, Machine Learning Department , Pittsburgh, PA Postdoctoral Research Associate, Supervisor: Pradeep Ravikumar	07/2024 - present
EDUCATION	Rensselaer Polytechnic Institute , Troy, NY Ph.D. in Electrical Engineering, Advisor: Ali Tajer <i>Dissertation: Causal Learning via Interventions: Estimation and Design</i>	05/2020 - 05/2024
	Rensselaer Polytechnic Institute , Troy, NY M.S. in Electrical Engineering	08/2018 - 05/2020
	Bogazici University , Istanbul, Turkey B.S. in Electrical & Electronics Engineering	09/2013 - 06/2018
RESEARCH INTERESTS	My research centers on the intersection of causality and machine learning. The overarching goal is to develop a methodology that models our world through a causality lens, capitalizing on shared causal mechanisms across diverse data environments. To achieve this, I use the language of <i>causal interventions</i> in a wide range of problems, including but not limited to unsupervised representation learning, causal structure learning, and the design of sequential interventions. More recently, my emphasis has been on causal representation learning from interventions, and more generally, identifiable representation learning .	
RESEARCH EXPERIENCE	Causal Representation Learning from Interventions <ul style="list-style-type: none">Designed a novel framework for analyzing causal representation learning via score functions under interventions. Established identifiability results along with provably correct algorithms.Published our results for general transformations at [AISTATS-2024]. The manuscript for the results on linear transformations is under revision for <i>JMLR</i>, and an earlier version – one of the first papers on interventional CRL – is available in arXiv. The paper on multi-node interventions is published at [NeurIPS-2024]. The first paper on the sample complexity of interventional CRL is also published at [NeurIPS-2024]. Intervention Design via Causal Bandits <ul style="list-style-type: none">Designed causal bandit algorithms with relaxed assumptions compared to the prior work. Established upper and lower bound regret guarantees for both static and time-varying systems. Published papers at [JMLR-2023], [JSAIT-2024], and [ISIT-2024]. Scalable Interventional Structure Learning <ul style="list-style-type: none">Developed consistent algorithms for efficient learning of intervention targets and improving the structure learning of causal graphs. Published papers for causally sufficient [NeurIPS-2021] and causally insufficient models [UAI-2022]. Structure Learning of Undirected Graphical Models <ul style="list-style-type: none">Developed algorithms for structure learning of shared subgraphs for multiple undirected graphical models, and analyzed sample complexities. Published results at [AISTATS-2021].	
PROFESSIONAL EXPERIENCE	Visiting Research Scholar at MIT-IBM Watson AI Lab Mentors: Dr. Dmitriy Katz-Rogozhnikov, Dr. Prasanna Sattigeri, Dr. Dennis Wei	Cambridge, MA 09/2022 - 12/2022

Designed a framework for the causal discovery of a mixture of DAGs and established identifiability conditions, published the results at [TMLR-2024]. Established the necessary and sufficient conditions for interventional causal discovery in mixture models and designed efficient algorithms, published at [NeurIPS-2024].

The Rensselaer-IBM AIRC Collaboration

AI Horizons Extern, Mentors: Dr. Prasanna Sattigeri, Dr. Karthikeyan Shanmugam 05/2020 - 08/2020

Researched on combining the causal discovery process with generative modeling and inducing a latent space representative of the underlying structure.

Speech Enabled Smart Technologies

Research Intern

Istanbul, Turkey

06/2017 - 08/2017

Built neural networks for a speaker identity verification system.

- PUBLICATIONS
1. M. Majid, R. Pukdee, V. Agrawal, **B. Varıcı**, and P. Ravikumar, “On the Consistent Recovery of Joint Distributions from Conditionals”, *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2025.
 2. **B. Varıcı**, E. Acartürk, K. Shanmugam, and A. Tajer, “Linear Causal Representation Learning from Unknown Multi-node Interventions”, *Neural Information Processing Systems (NeurIPS)*, 2024.
 3. **B. Varıcı**, D. Katz-Rogozhnikov, D. Wei, P. Sattigeri, and A. Tajer, “Interventional Causal Discovery in a Mixture of DAGs”, *Neural Information Processing Systems (NeurIPS)*, 2024.
 4. E. Acartürk, **B. Varıcı**, K. Shanmugam, and A. Tajer, “Sample Complexity of Interventional Causal Representation Learning”, *Neural Information Processing Systems (NeurIPS)*, 2024.
 5. **B. Varıcı**, E. Acartürk, K. Shanmugam, and A. Tajer, “General Identifiability and Achievability for Causal Representation Learning”, *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2024. (selected for **oral** presentation)
 6. **B. Varıcı**, E. Acartürk, K. Shanmugam, A. Kumar, and A. Tajer, “Score-based Causal Representation Learning: Linear and General Transformations”, arxiv:2402.00849, 2024 (*under revision for JMLR*).
 7. Z. Yan, A. Mukherjee, **B. Varıcı**, and A. Tajer, “Improved Bound for Robust Causal Bandits with Linear Models”, *International Symposium on Information Theory (ISIT)*, 2024.
 8. Z. Yan, A. Mukherjee, **B. Varıcı**, and A. Tajer, “Robust Causal Bandits for Linear Models”, *IEEE Journal on Selected Areas in Information Theory (JSAIT)*, 2024.
 9. **B. Varıcı**, D. Katz-Rogozhnikov, D. Wei, P. Sattigeri, and A. Tajer, “Separability Analysis for Causal Discovery in Mixture of DAGs”, *Transactions on Machine Learning Research (TMLR)*, 2024.
 10. **B. Varıcı**, E. Acartürk, K. Shanmugam, A. Kumar, and A. Tajer, “Score-based Causal Representation Learning with Interventions”, arXiv:2301.08230, 2023.
 11. **B. Varıcı**, K. Shanmugam, P. Sattigeri, and A. Tajer, “Causal Bandits for Linear Structural Equation Models”, *Journal of Machine Learning Research (JMLR)*, 2023.
 12. **B. Varıcı**, K. Shanmugam, P. Sattigeri, and A. Tajer, “Intervention Target Estimation in the Presence of Latent Variables”, *The Conference on Uncertainty in Artificial Intelligence (UAI)*, 2022.
 13. **B. Varıcı**, K. Shanmugam, P. Sattigeri, and A. Tajer, “Scalable Intervention Target Estimation in Linear Models”, *Neural Information Processing Systems (NeurIPS)*, 2021.
 14. **B. Varıcı**, S. Sihag, and A. Tajer, “Learning Shared Subgraphs in Ising Model Pairs”, *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2021.

UNDERGRAD RESEARCH	Boğaziçi University Signal and Image Processing Laboratory Senior Design Project, Advisor: Prof. Murat Saraclar	Istanbul, Turkey 10/2017 - 05/2018
	<ul style="list-style-type: none"> • Investigated deep learning techniques for Query-by-example speech search on low-resource languages. • Completed Bachelor thesis titled "Query-by-Example Speech Search with Neural Networks". 	
	University of Wisconsin-Madison Undergraduate Research Assistant, Advisor: Dr. Xinyu Zhang	Madison, WI 05/2016 - 07/2016
	<ul style="list-style-type: none"> • Researched on tracking the orientation of batteryless objects via RFID tags. • Analyzed characteristics of frequency channels to integrate localization to Gyro in the Air project. 	
ORGANIZING	Causal Representation Tutorial at AAAI Conference on Artificial Intelligence	02/2025
TALKS	Artificial Intelligence with Causal Techniques Workshop at AAAI Causal Representation Learning	03/2025
	Carnegie Mellon University - Statistical & Symbolic Learning Group Score-based Causal Representation Learning from Interventions	03/2024
	Causal Representation Learning Workshop at NeurIPS Score-based Causal Representation Learning from Interventions	12/2023
	IBM Causal Reinforcement Learning Group Causal Bandits for Linear Structural Equation Models	02/2023
AWARDS & HONORS	Allen B. Dumont Prize	2024
	NeurIPS Top Reviewer	2023
	UAI Top Reviewer	2023
	Jerry Dziuba ECSE Graduate Student Service Award	2022
	Belsky Award for Computational Sciences and Engineering	2022
	The Rensselaer-IBM AI Fellowship	2020-2024
	Undergraduate Science Fellowship of Government of Turkey	2013 - 2018
	University Entrance Exam - Ranked 276th out of 1.8 million candidates	2013
	Turkish National Mathematical Olympiad - Silver Medal	2012
	International Balkan Mathematical Olympiad - Silver Medal	2012
	International Junior Balkan Mathematical Olympiad - Gold Medal	2010
TEACHING EXPERIENCE	Guest Lecturer, Carnegie Mellon University CMU 10716: Advanced Machine Learning CMU 10741: Representation Learning	Pittsburgh, PA January 2025 November 2024
	Teaching Assistant, Rensselaer Polytechnic Institute ECSE 2410: Signals and Systems ECSE 2610: Computer Components and Operations ECSE 1010: Introduction to Electrical, Component and Systems Engineering	Troy, NY Spring 2020 Spring 2019 Fall 2018
SERVICE	Reviewer: NeurIPS (2021, 2022, 2023, 2024), UAI (2023, 2024), AAAI (2023), AISTATS (2024, 2025), IEEE Transactions on Signal Processing, Transactions on Machine Learning Research (TMLR).	