

# BURAK VARICI

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CURRENT POSITION	<b>Carnegie Mellon University, Machine Learning Department</b> , Pittsburgh, PA Postdoctoral Researcher, Supervisor: <a href="#">Pradeep Ravikumar</a>	07/2024 - present
EDUCATION	<b>Rensselaer Polytechnic Institute</b> , Troy, NY Ph.D. in Electrical Engineering, Advisor: <a href="#">Ali Tajer</a> <i>Dissertation: Causal Learning via Interventions: Estimation and Design</i>	05/2020 - 05/2024
	<b>Rensselaer Polytechnic Institute</b> , Troy, NY M.S. in Electrical Engineering	08/2018 - 05/2020
	<b>Bogazici University</b> , 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 <b>causal representation learning</b> from interventions, and more generally, <b>identifiable representation learning</b> .	
RESEARCH EXPERIENCE	<b>Causal Representation Learning from Interventions</b> <ul style="list-style-type: none"><li>Designed a novel framework for analyzing causal representation learning via score functions under interventions. Established identifiability results along with provably correct algorithms.</li><li>Published our results for general transformations at <a href="#">[AISTATS-2024]</a>. 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 <a href="#">arXiv</a>. The paper on multi-node interventions is published at <a href="#">[NeurIPS-2024]</a>. The first paper on the sample complexity of interventional CRL is also published at <a href="#">[NeurIPS-2024]</a>.</li></ul> <b>Intervention Design via Causal Bandits</b> <ul style="list-style-type: none"><li>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 <a href="#">[JMLR-2024]</a>, <a href="#">[JSAIT-2024]</a>, and <a href="#">[ISIT-2024]</a>.</li></ul> <b>Scalable Interventional Structure Learning</b> <ul style="list-style-type: none"><li>Developed consistent algorithms for efficient learning of intervention targets and improving the structure learning of causal graphs. Published papers for causally sufficient <a href="#">[NeurIPS-2021]</a> and causally insufficient models <a href="#">[UAI-2022]</a>.</li></ul> <b>Structure Learning of Undirected Graphical Models</b> <ul style="list-style-type: none"><li>Developed algorithms for structure learning of shared subgraphs for multiple undirected graphical models, and analyzed sample complexities. Published results at <a href="#">[AISTATS-2021]</a>.</li></ul>	
PROFESSIONAL EXPERIENCE	<b>Visiting Research Scholar at MIT-IBM Watson AI Lab</b> 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. **B. Varıcı**, E. Acartürk, K. Shanmugam, and A. Tajer, “Linear Causal Representation Learning from Unknown Multi-node Interventions”, *Neural Information Processing Systems* (NeurIPS), 2024.
  2. **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.
  3. E. Acartürk, **B. Varıcı**, K. Shanmugam, and A. Tajer, “Sample Complexity of Interventional Causal Representation Learning”, *Neural Information Processing Systems* (NeurIPS), 2024.
  4. **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)
  5. **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*).
  6. 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.
  7. 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.
  8. **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.
  9. **B. Varıcı**, E. Acartürk, K. Shanmugam, A. Kumar, and A. Tajer, “Score-based Causal Representation Learning with Interventions”, arXiv:2301.08230, 2023.
  10. **B. Varıcı**, K. Shanmugam, P. Sattigeri, and A. Tajer, “Causal Bandits for Linear Structural Equation Models”, *Journal of Machine Learning Research* (JMLR), 2023.
  11. **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.
  12. **B. Varıcı**, K. Shanmugam, P. Sattigeri, and A. Tajer, “Scalable Intervention Target Estimation in Linear Models”, *Neural Information Processing Systems* (NeurIPS), 2021.
  13. **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

- 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

- 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.

## TALKS

<b>Carnegie Mellon University - Statistical &amp; Symbolic Learning Group</b>	2024
Score-based Causal Representation Learning from Interventions	
<b>Causal Representation Learning Workshop at NeurIPS</b>	2023
Score-based Causal Representation Learning from Interventions	
<b>IBM Causal Reinforcement Learning Group</b>	2023
Causal Bandits for Linear Structural Equation Models	

AWARDS &  
HONORS

Allen B. Dumont Prize	2024
<b>NeurIPS Top Reviewer</b>	2023
<b>UAI Top Reviewer</b>	2023
<b>Jerry Dziuba ECSE Graduate Student Service Award</b>	2022
<b>Belsky Award for Computational Sciences and Engineering</b>	2022
<b>The Rensselaer-IBM AI Fellowship</b>	2020-2024
<b>Undergraduate Science Fellowship of Government of Turkey</b>	2013 - 2018
<b>University Entrance Exam</b> - Ranked 276 <sup>th</sup> out of 1.8 million candidates	2013
<b>Turkish National Mathematical Olympiad</b> - Silver Medal	2012
<b>International Balkan Mathematical Olympiad</b> - Silver Medal	2012
<b>International Junior Balkan Mathematical Olympiad</b> - Gold Medal	2010

TEACHING  
EXPERIENCE

<b>Teaching Assistance, Rensselaer Polytechnic Institute</b>	Troy, NY
ECSE 2410: Signals and Systems	Spring 2020
<b>Teaching Assistance, Rensselaer Polytechnic Institute</b>	Troy, NY
ECSE 2610: Computer Components and Operations	Spring 2019
<b>Teaching Assistance, Rensselaer Polytechnic Institute</b>	Troy, NY
ECSE 1010: Introduction to Electrical, Component and Systems Engineering	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).