BURAK VARICI

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Education

Rensselaer Polytechnic Institute, Troy, NY — *August 2018 - (expected) June 2024*
Ph.D. in Electrical Engineering, Advisor: Dr. Ali Tajer — GPA: 3.93/4.0

Rensselaer Polytechnic Institute, Troy, NY — *August 2018 - May 2020*
M.S. in Electrical Engineering — GPA: 3.9/4.0

Bogazici University, Istanbul, Turkey — *September 2013 - June 2018*
B.S. in Electrical & Electronics Engineering — GPA: 3.43/4.0

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 *causal interventions* in a wide range of research 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 exploring its potential applications.

Research Experience

RPI Information Sciences Group — *Troy, NY*
RPI-AIRC Scholar, Advisor: Dr. Ali Tajer — January 2020 - Present

Causal Representation Learning from Interventions
- Developed a novel framework for analyzing causal representation learning via score functions under interventions.
- Established identifiability results for various settings, multiple papers are under review process [P1], [P2].

Intervention Design via Causal Bandits
- Designed causal bandit algorithms with relaxed assumptions compared to the prior work. Established lower and upper bound regret guarantees. Published one paper at JMLR [J1].

Scalable Interventional Structure Learning
- Developed consistent algorithms for efficient learning of intervention targets and improving the structure learning of causal graphs.
- Published papers for both causally sufficient (NeurIPS [C2]) and causally insufficient systems (UAI [C3]).

Structure Learning of Undirected Graphical Models
- Developed algorithms for structure learning of shared subgraphs for multiple undirected graphical models, and analyzed sample complexities. Published one paper at AISTATS [C1].

RPI Intelligent Systems Laboratory — *Troy, NY*
Graduate Research Assistant, Advisor: Dr. Qiang Ji — August 2018 - December 2019
- Researched on low-cost eye-gaze tracking systems, and leveraged probabilistic methods to personalize deep models with limited annotation.

Boğaziçi University Signal and Image Processing Laboratory — *Istanbul, Turkey*
Senior Design Project, Advisor: Dr. Murat Saraclar — October 2017 - May 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 *Madison, WI*
Undergraduate Research Assistant, Advisor: Dr. Xinyu Zhang May - July 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.

Professional Experience

Visiting Research Scholar at MIT-IBM Watson AI Lab *Cambridge, MA*
Mentors: Dr.Dmitriy K. Rogozhnikov, Dr.Prasanna Sattigeri, Dr.Dennis Wei September - December 2022

Proposed a framework for causal discovery from a mixture of DAGs, and established identifiability conditions for causal relationships in the mixture. The paper is under review process [P3].

The Rensselaer-IBM AIRC Collaboration
AI Horizons Extern, Mentors: Dr. Prasanna Sattigeri, Dr. Karthikeyan Shanmugam May - August 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 *Istanbul, Turkey*
Summer Intern June - August 2017

Built neural networks for a speaker identity verification system.

Publications

J1 **B. Varıcı**, K. Shanmugam, P. Sattigeri, and A. Tajer, "Causal Bandits for Linear Structural Equation Models", *Journal of Machine Learning Research (JMLR), 2023.*

C3 **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.

C2 **B. Varıcı**, K. Shanmugam, P. Sattigeri, and A. Tajer, "Scalable Intervention Target Estimation in Linear Models", *Neural Information Processing Systems* (NeurIPS), 2021.

C1 **B. Varıcı**, S. Sihag, and A. Tajer, "Learning Shared Subgraphs in Ising Model Pairs", *International Conference on Artificial Intelligence and Statistics* (AISTATS), 2021.

Preprints

P1 **B. Varıcı**, E. Acartürk, K. Shanmugam, A. Kumar, and A. Tajer, "Score-based Causal Representation Learning with Interventions", *under review.*

P2 **B. Varıcı**, E. Acartürk, K. Shanmugam, and A. Tajer, "General Identifiability and Achievability for Causal Representation Learning", *Causal Representation Learning Workshop at NeurIPS 2023 (oral)*, and *under review for AISTATS.*

P3 **B. Varıcı**, D. Katz-Rogozhnikov, A. Tajer, D. Wei, and P. Sattigeri, "Separability Analysis for Causal Discovery in Mixture of DAGs", *under review.*

P4 Z. Yan, A. Mukherjee, **B. Varıcı**, and A. Tajer, "Robust Causal Bandits for Linear Models", *under review.*

Skills and Coursework

Technical: Python, TensorFlow/PyTorch, MATLAB

Relevant Graduate Courses: Learning from Data, Deep Learning, Probabilistic Graphical Methods, Distributed Machine Learning, Trustworthy Machine Learning, Bandit Algorithms, Computational Optimization, Computer Vision, Speech Processing.

Awards & Honors

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 AIRC Fellowship *2020*

Undergraduate Science Fellowship of Government of Turkey *2013 - 2018*

University Entrance Exam - Ranked 276^{th} out of 1.8 million candidates *2013*

Turkish National Mathematical Olympiad - Silver Medal *2012*

International Balkan Mathematical Olympiad - Silver Medal *2012*

Teaching Experience

Teaching Assistance, Rensselaer Polytechnic Institute Troy, NY
ECSE 2410: Signals and Systems *Spring 2020*

Teaching Assistance, Rensselaer Polytechnic Institute Troy, NY
ECSE 2610: Computer Components and Operations *Spring 2019*

Teaching Assistance, Rensselaer Polytechnic Institute Troy, NY
ECSE 1010: Introduction to Electrical, Component and Systems Engineering *Fall 2018*

Service

Reviewer: NeurIPS (2021, 2022, 2023), UAI (2023), AAAI (2023), AISTATS (2024), IEEE Transactions on Signal Processing