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 focuses on the intersection of causality and machine learning. I aim to develop a methodology for modeling our world from a causality lens and leverage the shared causal mechanisms across different data environments. To that end, I use the language of *causal interventions* in a broad range of research problems that include but are not limited to unsupervised representation learning, causal structure learning, and sequential intervention design.

Research Experience

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

Causal Representation Learning via 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", *under review.*

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

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