Mohammadsajad Abavisani

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PERSONAL STATEMENT

Final-year PhD candidate in Electrical and Computer Engineering at Georgia Tech, with seven years of experience in machine learning, causal inference, and time series analysis. Actively seeking internship opportunities for Spring and Summer 2025, as well as full-time positions starting in Fall or Winter 2025. Eager to apply and further develop expertise in causal learning, deep learning, and advanced time series analysis to solve complex, real-world challenges.

EDUCATION

Aug 2020 – Dec 2025 **Georgia Institute of Technology**
Atlanta, GA
Ph.D. in Electrical and Computer Engineering (GPA: 3.9/4)
Coursework: Conversational A.I., Mathematical Foundations of Machine Learning, Machine Learning with Limited Supervision, Random Processes, Information Theory, Statistical Machine Learning, Convex Optimization.
Research Area: Time Series Analysis, Causal Inference, Deep Learning and Optimization for Neuroimaging.

Aug 2020 – Aug 2023 **Georgia Institute of Technology**
Atlanta, GA
Master of Science in Electrical and Computer Engineering (GPA: 3.9/4)

Sep 2014 – Sep 2019 **Ferdowsi University of Mashhad**
Mashhad, Iran
B.S. in Electrical Engineering (GPA: 4/4)
Electives: Advanced Programming, Algorithm Design, Data Structure, Soft Computing, Digital Signal Processing, Digital Communications, Artificial Intelligence, Probability and Stochastic Processes.

SKILLS

Programming: Python (NetworkX, igraph, Numpy, SciPy, Scikit-learn, PyTorch, TensorFlow, Pandas, etc.), C++ (OpenCV, Emgu, AForge), Matlab, JAVA, Clingo, R.
Machine Learning & Frameworks: Multimodal Large Language Models (LLMs), Transformers, Conformers, PyTorch (CUDA), TensorFlow, Predictive Modeling, Statistical Modeling, Optimization, Git, Tigramite.
Computer Vision & Speech Processing: Generative Models (GANs, Diffusion Models), Self-Supervised Models, Cross-modal Data Generation, Vision-Language Alignment, Speech-to-Text Models, Multimodal Model Integration.
Other: Algorithm Development, Parallel Computing, Open-Source Contributions, Scalable Solutions.

RESEARCH EXPERIENCE

Aug 2020 – Present **Center for Translational Research in Neuroimaging and Data Science (TReNDS)** *(Graduate Research Assistant)*

Key Achievements:

- Contributed to algorithmic causal understanding in large-scale dynamic systems. My advancement has enabled the application of previously theoretical causal discovery methods to real-world brain networks for the first time. In addition, the open-source code base I helped developed was used for several collaborations to use my formulation of causal discovery in other tasks, resulting is 3 papers so far.
- **Machine Learning and Algorithm Development:** Conducted advanced research in machine learning, predictive modeling, and statistical analysis of time series data, particularly with limited time points and noisy real-world datasets like fMRI data. Employed deep learning frameworks such as PyTorch and TensorFlow, as well as graph theory and advanced mathematical tools, to address challenges in causal inference and time series prediction.
- **Scalable Solutions and Parallel Computing:** Developed a pioneering scalable algorithm for causal structure discovery, leveraging a novel graph theorem to enhance runtime efficiency by over 1,000x compared to existing benchmarks. Adapted machine learning methods to exploit modern parallel environments, including distributed clusters and GPUs, optimizing performance for large-scale data processing.
- **Open-Source Contributions:** Implemented the causal discovery method into a pip-installable package called gunfolds, facilitating broader adoption and collaboration within the research community.
- **Cross-Functional Collaboration:** Built strong partnerships with interdisciplinary teams, collaborating closely with engineers and data scientists to design and deliver high-quality, reliable machine learning solutions.
- **Multimodal LLM Exploration:** Investigated LLMs to model multimodal data, combining text, image, and time series data for various use cases in brain data analysis.
- **Research Publications and Presentations:** Published a top 25% paper at ICLR 2023 and presented findings at several conferences and workshops, including NeurIPS, demonstrating the ability to translate complex insights into actionable recommendations and contribute to the academic community.
- **Technical Proficiency:** Skilled in programming languages such as Python, C++, and scripting languages like JavaScript. Experienced in developing classifiers and tools leveraging machine learning, regression, and rule-based models.

- **Problem-Solving and Analytical Skills:** Led research to optimize solutions for noisy real-world time series data using advanced statistical techniques. Explored innovative approaches like deliberate undersampling to improve estimation accuracy, challenging conventional assumptions and advancing the field of causal inference.
- **Communication and Leadership:** Excelled in communicating complex technical concepts to diverse audiences and engaged in critical discussions with other researchers. Demonstrated leadership in collaborative projects, leading to successful research outcomes and publications.

Sep 2018 - Dec 2019 **Volunteer Research, In Collaboration with Rutgers University** (*Volunteer Researcher)*

- **Data Augmentation for Deep Learning:** Created a fast, greedy-based algorithm for automatic dataset augmentation, improving deep learning model performance in vision tasks with an emphasis on optimizing model robustness across diverse data types.

Dec 2017 – Sep 2019 **Robotic Prosthetic Control** *(Undergraduate Research Assistant)*

- **Computer Vision and Neural Networks:** Designed a neural network for interpreting muscular movements in amputees to control prosthetic devices using multimodal data from muscle signals and **vision-based models**.
- **Machine Learning in Healthcare:** Created a pipeline using convolutional neural networks (CNNs) and restricted Boltzmann machines to improve unsupervised learning for robotic control.
- **Multimodal Integration:** Integrated multimodal inputs (muscle and vision) into neural networks to enhance gesture recognition accuracy, contributing to a real-world application of prosthetics.

PUBLICATIONS

- **M. Abavisani**, D. Danks, S. Plis *GRACE-C: Generalized Rate Agnostic Causal Estimation via Constraints*. International Conference on Learning Representations (ICLR2023) accepted for Oral presentation (Top 25%).
- Solovyeva, K., Danks, D., **Abavisani, M.**, Plis, S. *Causal Learning through Deliberate Undersampling.* Proceedings of the Second Conference on Causal Learning and Reasoning, PMLR. (2023)
- Solovyeva, K., Danks, D., **Abavisani, M.**, & Plis, S. *Reducing Causal Illusions through Deliberate Undersampling.* In A causal view on dynamical systems, NeurIPS 2022 workshop. (2022)
- A. Naghizadeh, **M. Abavisani**, D. Metaxas. *Greedy AutoAugment*. Pattern Recognition Letters Journal - Elsevier.
- A. Mobiny, P. Cicalese, S. Zare, P. Yuan, **M. Abavisani**, C. Wu, J. Ahuja, P. Groot, H. Nguyen. *Radiologist-Level COVID-19 Detection Using CT scans with Detail-Oriented Capsule Networks. (2020)*

Preprint:

- **M. Abavisani**, D. Danks, V. Calhoun, S. Plis *Piecing Together the Causal Puzzle: How Answer Set Programming Cracks the Code With Large Scale Noisy Time Series*
- P. Nair, P Bhandari, **M. Abavisani**, S. Plis, D. Danks *ION-C: Integration of Overlapping Networks via Constraints* (ICLR25 submitted)

PROJECTS

Aug 2020 – Present **Georgia Tech Course Projects**

- **Large Language Models:** Working with open source Llama 3 model, worked on integrating LLM with knowledge graphs to improve language models ability to work through riddles and improve logic representation.
- **Generative Adversarial Networks (GANs):** Trained GANs to augment and improve the classification of street signs for self-driving cars. Improved robustness to various weather conditions by leveraging multimodal inputs (image and text).
- **Topology-Aware Self-Supervised Learning:** Developed a contrastive learning framework with a topology loss term to reduce texture bias in CNNs, advancing generalization in computer vision tasks. This project emphasized shape bias in recognition tasks by using **multimodal techniques** for feature alignment.
- **Dynamical System Prediction with Neural Networks:** Built neural networks (PhICNet) to predict systems governed by partial differential equations (PDEs). Integrated multimodal data sources (physics and image data) into the network for enhanced prediction of spatio-temporal dynamics.

Jun 2017 – Dec 2017 **Internship**

- Engineered an eye gaze tracking device from the ground up, with a primary focus on coding the eye tracking algorithm using C#.NET, OpenCV, Emgu, and AForge libraries. Developed a highly accurate system to detect a user's gaze on a monitor, ensuring precision and reliability. Led this complex and demanding project, making a meaningful contribution to the company's mission by delivering an innovative and robust solution.

HONORS

- Top 25% paper accepted at ICLR2023
- Ranked 3rd on **ACM** (Association for Computing Machinery) programming competitions.
- Ranked in top 0.001% (**Ranked 537th among 1M participant**) in the nationwide university entrance exams.
- Ranked in top 5% Among All Engineering Students in Ferdowsi University class of 2014 based on GPA.
- Accepted into National Organization for Development of Exceptional Talents (**NODET**) for high school.