

Saeed Mohseni seh deh

✉ saeedmohseniph@gmail.com | 🌐 Personal Website | 🔗 LinkedIn | 📄 Google Scholar | 🐙 GitHub

Research Interests

PhD student in Electrical Engineering at Virginia Tech working on causal inference, generative models, and statistical machine learning, with an emphasis on methods that carry mathematical performance guarantees. Applied interests span quantitative finance, AI/ML technologies, wireless communications and networking, and signal processing.

Education

Virginia Tech Dec 2023 - Dec 2027
PhD in Electrical Engineering, Advisor: Dr. Walid Saad
GPA: 4.0/4.0

Research: Causal Learning and Generative Models for High-Dimensional Data

Sharif University of Technology Sep 2020 - Sep 2022
MSc in Electrical Engineering, Advisor: Dr. Massoud Babaie-Zadeh
GPA: 3.7/4.0

Thesis: Dictionary Learning for Sparse Representation-based Classification

Amirkabir University of Technology Sep 2016 - Sep 2020
BSc in Electrical Engineering, Advisor: Dr. Hamidreza Amindavar
GPA: 4.0/4.0

Thesis: Sketching for Sequential Change-point Detection

Publications

1. S. Mohseni-Sehdeh, W. Saad, K. Sakaguchi, and T. Yu, "Diffusion Models for Solving Inverse Problems via Posterior Sampling with Piecewise Guidance," *Transactions on Machine Learning Research (TMLR)*, April 2026. [\[OpenReview\]](#) [\[Code\]](#)
2. S. Mohseni-Sehdeh and W. Saad, "Induced Covariance for Causal Discovery in Linear Sparse Structures", *IEEE Signal Processing Letters*, under review. [\[arXiv\]](#)
3. S. Mohseni-Sehdeh, W. Saad, K. Sakaguchi, and T. Yu, "Causal Digital Twins for Physical System Control," in *Proc. of 59th Annual Conference on Information Sciences and Systems (CISS)*, pp. 1–6, Mar. 2025. [\[DOI\]](#)
4. S. Mohseni-Sehdeh and M. Babaie-Zadeh, "A fast dictionary-learning-based classification scheme using undercomplete dictionaries," *Signal Processing*, vol. 212, p. 109124, Nov. 2023. [\[DOI\]](#) [\[Code\]](#)

Research Experience

Graduate Research Assistant | Virginia Tech **Dec 2023 – Present**

- Developed a diffusion-based method for inverse problems using piecewise guidance and multi-GPU parallelization in PyTorch, achieving $\geq 23\%$ faster recovery on ImageNet with comparable PSNR/SSIM. (**S. Mohseni-Sehdeh et al.**, *TMLR*, 2026)¹
- Designed a novel causal discovery algorithm leveraging our newly introduced induced covariance, achieving 35% higher precision and 41.5% higher recall than existing methods. ²
- Engineered a modular digital twin-based control system for signal tracking, achieving 49% lower MSE than classical control and 16% lower MSE using causal versus statistical learning in low-data self-training regimes. (**S. Mohseni-Sehdeh et al.**, *CISS*, 2025) ³

Graduate Research Assistant | Sharif University of Technology **Aug 2021 – Jun 2023**

- Developed 2 novel algorithms in sparse signal processing and overcomplete dictionary learning for signal classification, improving accuracy over baseline methods.
- Developed a resource-efficient dictionary-based classification algorithm using undercomplete dictionaries, achieving $10\times$ faster inference and $100\times$ faster training than competing methods while maintaining or improving accuracy. (**S. Mohseni-Sehdeh et al.**, *Signal Processing*, 2023) ⁴

Teaching Experience

Teaching Assistant, *Senior Design Project* | Virginia Tech **Jan 2024 – Dec 2024**

- Mentored and evaluated 8 student teams (32 students) on industry-oriented engineering projects and helped organize a university-wide project expo.

Teaching Assistant, *Advanced Communications* | Sharif University of Technology **Mar 2022 – Aug 2022**

- Conducted recitation sessions for a graduate-level telecommunications course, reviewing course material and answering student questions.

Teaching Assistant, *Adaptive Filters* | Sharif University of Technology **Oct 2021 – Feb 2022**

- Conducted recitation sessions for a graduate-level adaptive filtering course, reviewing course material and answering student questions.

Teaching Assistant, *Digital Signal Processing* | Amirkabir University of Technology **Feb 2020 – Feb 2021**

- Taught MATLAB for signal processing and supported students with programming questions during office hours.
- Designed and graded computer assignments to reinforce core signal processing concepts.

Selected Projects

Cointegration Statistical Arbitrage | [GitHub](#)

- Built a walk-forward pairs-trading pipeline (Python, statsmodels/SciPy): screened pairs for cointegration (Engle–Granger, FDR-corrected) and traded z-score mean-reversion with half-life sizing and Kalman-filtered hedge ratios.
- On the Mastercard/Visa pair, delivered a Sharpe of 1.26 (+11.4%/yr, deflated Sharpe ≈ 0.97 , profitable 11/11 years), while 0 of 210 blindly-searched semiconductor pairs survived multiple-testing correction.
- Validated with bootstrap Sharpe confidence intervals and a Probabilistic Sharpe Ratio.

Dynamic Hedging Lab, Realized vs. Implied Volatility P&L | [GitHub](#)

- Built a vectorized Monte-Carlo delta-hedging engine (Python, NumPy/SciPy) that isolates a hedged option's P&L as gamma-weighted exposure to the gap between realized and implied variance, validated path-by-path.
- Characterized how discrete-hedging error shrinks with rebalancing frequency and solved for the cost-optimal frequency that trades off replication error against transaction costs.
- Attributed a real SPY-call hedge P&L to the variance risk premium (realized 13.4% vs. implied 15.8%).

Unsupervised S&P 500 Momentum Strategy | [GitHub](#)

- Built an end-to-end systematic equity pipeline on 10 years of S&P 500 data: technical and Fama–French factor features, monthly K-means clustering of the standardized cross-section, and 12-1 momentum-based cluster selection.
- Sized the book with max-Sharpe optimization net of a 10 bps turnover cost; realized Sharpe 1.07 vs. 0.87 (SPY) and 0.79 (equal-weight RSP), with $\sim +14\%$ annualized alpha over 2018–2025.

TinyStories LLM, Small Language Model from Scratch | [GitHub](#)

- Built and trained a 4.8M-parameter GPT-style transformer from scratch in PyTorch on the TinyStories dataset, reaching a final validation loss of 1.4.
- Implemented multi-head attention, positional embeddings, and layer normalization manually, developing a deep understanding of transformer internals and training dynamics.

Joint Object and Depth Detection on NYU Depth Dataset V2

- Developed a pipeline for simultaneous object detection and depth estimation using DenseNet-169 (14M parameters, ImageNet-pretrained) as a feature extractor.
- Applied YOLO for object detection and a CNN-based model for per-object depth estimation, achieving a validation MSE of 1.21 and demonstrating robust multi-task learning on high-dimensional image data.

*Additional projects and reports are available [here](#).

Technical & Analytical Skills

Programming Languages: Python, MATLAB, C

Libraries & Frameworks: NumPy, Pandas, SciPy, statsmodels, Scikit-learn, PyTorch, TensorFlow

Machine Learning: Deep Learning (CNNs, RNNs/LSTMs, Transformers), Generative Models, Causal Inference, Clustering, Dictionary Learning

Quantitative & Statistical Methods: Statistical Inference, Time-Series Analysis, Stochastic Processes, Monte Carlo Simulation, Numerical Optimization, Bayesian Inference, Hypothesis Testing, Regression Analysis, Backtesting

Signal Processing & Communications: Digital Signal Processing, Adaptive Filters, Information Theory & Coding, Sparse Representation, Wireless/Cellular Communications

Other Tools: Git, LaTeX, MATLAB Simulink

Relevant Coursework: Statistical Inference, Random Processes, Probability Theory, Data Analytics, Deep Learning, Linear Algebra, Numerical Optimization, Numerical Analysis, Information Theory, Digital Signal Processing, Control Systems, Cellular & Mobile Communications, Telecommunications Networks

Honors & Certificates

- **Fully Funded Ph.D. Student**, Virginia Tech, USA (Present).
- **Fully Funded M.Sc. in Electrical Engineering**, admitted as an *Exceptional Talent Student* to a top-ranked university in Iran.
- **Ranked 2nd** in B.Sc. Electrical Engineering class, Amirkabir University of Technology, Iran.
- **Reinforcement Learning Specialization**, Coursera (University of Alberta, Jun 2022). [\[Link\]](#)
- **Generative Adversarial Networks (GANs) Specialization**, Coursera (DeepLearning.AI, Oct 2021). [\[Link\]](#)
- **Deep Learning Specialization**, Coursera (DeepLearning.AI, Aug 2021). [\[Link\]](#)