Pedram Akbarian

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Education

The University of Texas at Austin Aug. 2019 – Present
Ph.D. in Electrical and Computer Engineering (GPA: 4.0/4.0) *Austin, TX*
Advisors: Prof. Nhat Ho and Prof. Atlas Wang

University of Tehran Sept. 2014 – May 2019
B.Sc. in Electrical Engineering (*Minor* in Computer Engineering) *Tehran, Iran*
Thesis: "Sparse Subspace Clustering (SSC); Applications in Human Motion Segmentation"
Advisor: Prof. Babak N. Araabi

Research Interests

- ◇ **Efficient Training and Inference for Foundation Models:** Focusing on statistical efficiency and training dynamics of Mixture of Experts (MoE) to improve scalability and performance of (large) foundation models.
- ◇ **Time Series Foundation Models:** Focusing on fundamental limits and methodologies to develop scalable and generalizable models for time series analysis, with a focus on improving the numerical reasoning capabilities.

Research Experience

Research Assistant, *The University of Texas at Austin, TX* Aug. 2019 – Present

- ◇ Theoretical and practical aspects of **Mixture of Experts (MoE)** in scalable and efficient foundation models.

Research Intern, *Toyota InfoTech Lab, Mountain View, CA* Jan. 2024 – Present

- ◇ Developing **time series foundation models** with a focus on scalability and efficiency to handle large-scale data.
- ◇ Enhancing the **scalability and efficiency of time series forecasting models** by integrating Mixture of Experts (MoE) into transformer and non-transformer architectures.

Data Science Intern, *H-E-B, San Antonio, TX* Summer 2022

- ◇ Developed an online optimization algorithm for **order batching** problem with time and space constraints.

Research Intern, *CognitiveScale, Austin, TX* Summer 2021

- ◇ Developed methods for **counterfactual explanations** in time series data.

Honors and Awards

- ◇ **Silver Medal** recipient in the 26$^{\text{th}}$ Iranian National Physics Olympiad Sept. 2013
- ◇ **Bronze Medal** recipient in the 25$^{\text{th}}$ Iranian National Physics Olympiad Sept. 2012
- ◇ Recipient of the **Grant** from the **National Elites Foundation**, Nov. 2014 – Jun. 2019
  for Silver and Bronze Medals of National Physics Olympiad and outstanding academic success

Preprints

[2] Fanqi Yan, Huy Nguyen, **Pedram Akbarian**, Nhat Ho, and Alessandro Rinaldo. "Sigmoid Self-Attention is Better than Softmax Self-Attention: A Mixture-of-Experts Perspective". *arXiv:2502.00281* (2025). (Under review).

[4] **Pedram Akbarian***, Huy Nguyen*, Xing Han*, and Nhat Ho. "Quadratic Gating Functions in Mixture of Experts: A Statistical Insight". *arXiv:2410.11222* (2024). (Under review).

Publications

[1] Huy Nguyen, **Pedram Akbarian***, Trang Pham*, Trang Nguyen, Shujian Zhang, and Nhat Ho. "Statistical Advantages of Perturbing Cosine Router in Sparse Mixture of Experts". *The Thirteenth International Conference on Learning Representations **(ICLR)***. 2025.

[3] Fanqi Yan, Huy Nguyen, Dung Le, **Pedram Akbarian**, and Nhat Ho. "Understanding Expert Structures on Minimax Parameter Estimation in Contaminated Mixture of Experts". *The 28th International Conference on Artificial Intelligence and Statistics **(AISTATS)***. 2025.

[5] **Pedram Akbarian***, Tongzheng Ren*, Jiacheng Zhuo, Sujay Sanghavi, and Nhat Ho. "Improving Computational Complexity in Statistical Models with Local Curvature Information". *Proceedings of the International Conference on Machine Learning **(ICML)***. 2024.

[6] Huy Nguyen, **Pedram Akbarian**, and Nhat Ho. "Is Temperature Sample Efficient for Softmax Gaussian Mixture of Experts?" *Proceedings of the International Conference on Machine Learning **(ICML)***. 2024.

[7] Huy Nguyen, **Pedram Akbarian**, Trungtin Nguyen, and Nhat Ho. "A General Theory for Softmax Gating Multinomial Logistic Mixture of Experts". *Proceedings of the International Conference on Machine Learning **(ICML)***. 2024.

[8] Huy Nguyen, **Pedram Akbarian**, Fanqi Yan, and Nhat Ho. "Statistical Perspective of Top-K Sparse Softmax Gating Mixture of Experts". *The Twelth International Conference on Learning Representations **(ICLR)***. 2024.

[9] Tina Han, Jette Henderson, **Pedram Akbarian**, and Joydeep Ghosh. "Improving Counterfactual Explanations for Time Series Classification Models in Healthcare Settings". *NeurIPS 2022 Workshop on Learning from Time Series for Health*. 2022.

(* denotes equal contribution.)

Selected Course Projects

Advanced Machine Learning Spring 2023
Supervisor: Prof. Alex Dimakis
- ◇ Attack Adversarial Purification with Diffusion Models: [Report]

Online Learning Fall 2021
Supervisor: Prof. Sanjay Shakkottai
- ◇ Linear Bandits with Stochastic Delayed Feedback: [Slides]

Advanced Topics in Machine Learning Spring 2021
Supervisor: Prof. Qiang Liu
- ◇ Self-supervised Learning via Bootstraping the Latent Space Representation: [Slides]
- ◇ InstaHide, Phase Retrieval, and Sparse Matrix Factorization: [Slides]

Advanced Probability Fall 2020
Supervisor: Prof. Sanjay Shakkottai
- ◇ Mean-field Analysis of Two-layers Neural Networks: [Report][Slides]

Combinatorial Optimization Fall 2020
Supervisor: Prof. Constantine Caramanis
- ◇ Submodular Meta-Learning: [Report]

Selected Teaching Experience (Graduate courses are indicated by †)

Graduate Teaching Assistant, *The University of Texas at Austin*

- ◇ **Probability & Stochastic Processes**†
- ◇ **Probability/Random Processes**
- ◇ **Digital Signal Processing**
- ◇ **Statistical Machine Learning**†
- ◇ **Data Science Principles**
- ◇ **Data Science Lab**

Undergraduate Teaching Assistant, *University of Tehran*

- ◇ **Pattern Recognition**†
- ◇ **Statistical Inference**†

Relevant Graduate Courses (Graduate courses taken during undergraduate studies are indicated by †)

- ◇ **Information Theory** Spring 2022
- ◇ **Stochastic Control Theory** Spring 2021
- ◇ **Combinatorial Optimization** Fall 2020
- ◇ **Large Scale Optimization II** Spring 2020
- ◇ **Probabil. & Stochastic Procs.** Fall 2019
- ◇ **Stochastic Processes**† Fall 2018
- ◇ **Online Learning** Fall 2021
- ◇ **Advanced Probability** Fall 2020
- ◇ **Theoretical Statistics** Spring 2020
- ◇ **Statistical Machine Learning** Spring 2020
- ◇ **Convex Optimization** Fall 2019
- ◇ **Pattern Recognition**† Fall 2017

Professional Services

- ◇ Reviewer at the International Conference on Learning Representations (ICLR) 2025.
- ◇ Reviewer at the Association for the Advancement of Artificial Intelligence (AAAI) 2025.
- ◇ Reviewer at the International Conference on Artificial Intelligence and Statistics (AISTATS) 2024-2025.
- ◇ Reviewer at the Conference on Neural Information Processing Systems (NeurIPS) 2024.

Skills

- ◇ **Programming Languages:** Python (*proficient*), C/C++, SQL, MATLAB, R, LaTeX
- ◇ **Software and Frameworks:** PyTorch (*proficient*), TensorFlow, Hugging Face, Git

References

Available upon request.