Pedram Akbarian Saravi

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Research Interests

- ◇ Machine Learning Theory
- ◇ Federated Learning
- ◇ Scalable AI
- ◇ High-dimensional Statistics

Education

University of Texas at Austin, Austin, TX
Ph.D., Department of Electrical and Computer Engineering GPA: 4.00/4.00
Advisor: Prof. Nhat Ho

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

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 [1] 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

Research Experience

Research Assistant, *Wireless Networking & Communications Group (WNCG), UT Austin*

- ◇ Efficient scalable AI using **Mixture of Experts (MoE)** models.
- ◇ Proximal Gradient Methods For **Multi-objective Optimization** by Hamilton-Jacobi PDE.
- ◇ Efficient second-order optimization in singular statistical methods.
- ◇ Conducted research on efficient and privacy-preserving Federated Learning models such as
  - Federated Learning via **Structured Weight Growth** Under Communication and Memory Constraints.
  - Efficient **Neural Network Compression** in Distributed Settings.
  - **Semi-supervised Personalized Federated Learning** by Exploiting Shared Representations.

Research Intern, *CognitiveScale, Austin, TX* Summer 2021
Supervisor: Prof. Joydeep Ghosh & Dr. Jette Henderson
Working on **Counterfactual explanations** for Time-Series data.

Research Assistant, *Machine Learning & Comp. Modeling Lab, University of Tehran* Aug. 2018 - Jun. 2019
Supervisor: Prof. Babak N. Araabi
Sparse Subspace Clustering (SSC) algorithm; its theoretical analysis and extensions to deal with practical data.

Publications

[1] Tina Han, Jette Henderson, Pedram Akbarian, and Joydeep Ghosh. Improving counterfactual explanations for time series classification models in healthcare settings. In *NeurIPS 2022 Workshop on Learning from Time Series for Health*, 2022

[2] Huy Nguyen, Pedram Akbarian, TrungTin Nguyen, and Nhat Ho. A general theory for softmax gating multinomial logistic mixture of experts, 2023

[3] Huy Nguyen, Pedram Akbarian, Fanqi Yan, and Nhat Ho. Statistical perspective of top-k sparse softmax gating mixture of experts. *ArXiv*, abs/2309.13850, 2023

[1] One of the three students of 10$^{\text{th}}$ grade who won a medal among almost 10,000 participants of 10$^{\text{th}}$ and 11$^{\text{th}}$ grades.

Selected Teaching Experience (Graduate courses are indicated by †)

Teaching Assistant, *University of Texas at Austin*

- ◇ **Statistical Machine Learning**† Spring 2023
  Instructor: Prof. Haris Vikalo
- ◇ **Data Science Principles** Fall 2021
  Instructor: Prof. Sujay Sanghavi
- ◇ **Digital Signal Processing** Fall 2020
  Instructor: Prof. Haris Vikalo
- ◇ **Probability & Stochastic Processes**† Fall 2022
  Instructor: Prof. Gustavo de Veciana
- ◇ **Statistical Machine Learning**† Spring 2021
  Instructor: Prof. Haris Vikalo
- ◇ **Data Science Lab** Fall 2019
  Instructor: Prof. Constantine Caramanis

Teaching Assistant, *University of Tehran*

- ◇ **Pattern Recognition**† Fall 2018
  Instructor: Prof. Babak N. Araabi
- ◇ **Statistical Inference**† Fall 2018
  Instructor: Prof. Mohammadreza A. Dehaqani

Selected Course Projects

Advanced Machine Learning Spring 2023
Supervisor: Prof. Alex Dimakis
- ◇ **Attack Adversarial Purification with Diffusion Models**: [Report]
  Investigating the effectiveness of diffusion-based model adversarial purification methods.

Online Learning Fall 2021
Supervisor: Prof. Sanjay Shakkottai
- ◇ **Linear Bandits with Stochastic Delayed Feedback**: [Slides]
  Working on the Regret analysis of OFTLinUCB algorithm for linear bandits under delayed feedback setting.

Advanced Topics in Machine Learning Spring 2021
Supervisor: Prof. Qiang Liu
- ◇ **Self-supervised Learning via Bootstraping the Latent Space Representation**: [Slides]
  Working on an optimization framework for self-supervised learning to avoid collapsed representations without relying on negative pairs.
- ◇ **InstaHide, Phase Retrieval, and Sparse Matrix Factorization**: [Slides]
  Working on the analysis of the InstaHide algorithm's privacy as a multi-task phase retrieval problem with missing data.

Advanced Probability Fall 2020
Supervisor: Prof. Sanjay Shakkottai
- ◇ **Mean-field Analysis of Two-layers Neural Networks**: [Report][Slides]
  Working on the convergence analysis of SGD for two-layer neural networks in the mean-field regime.

Combinatorial Optimization Fall 2020
Supervisor: Prof. Constantine Caramanis
- ◇ **Submodular Meta-Learning**: [Report]
  Working on the convergence analysis of a greedy algorithm for discrete meta-learning problem.

Skills

- ◇ **Programming Languages:** Python, C/C++, SQL, Matlab, R, LaTeX
- ◇ **Softwares and Frameworks:** PyTorch, Tensorflow, Mathematica, CVX/CVXPY

References

Available upon request.