

# Ali L. Rezaabad

GREEN CARD HOLDER

2501 Speedway, Austin, TX 78712

☎ (240) 302-0810 | ✉ [alotfi@austin.utexas.edu](mailto:alotfi@austin.utexas.edu) | 🏠 [Homepage](#) | 🐙 [Github](#) | 🔗 [LinkedIn](#) | 🎓 [Google Scholar](#)

## Education

### The University of Texas at Austin, ECE Department

PH.D. CANDIDATE IN ELECTRICAL & COMPUTER ENGINEERING WITH FOCUS ON MACHINE LEARNING

- Contrastive Representation Learning, Domain Adaptation, Generative Models, Adversarial Training

Texas, USA

Aug. 2017 - Nov. 2022

### Sharif University of Technology, EE Department

M.SC. IN ELECTRICAL ENGINEERING WITH FOCUS ON COMMUNICATION SYSTEMS

- Optimization, Millimeter Wave Cellular Networks, Wireless Communication Systems

Tehran, Iran

Aug. 2014 - June 2016

### University of Kerman, EE Department

B.SC. IN ELECTRICAL ENGINEERING WITH FOCUS ON COMMUNICATION SYSTEMS

- MIMO wireless communication, Space-Time Block Codes (STBC)

Kerman, Iran

Aug. 2010 - June 2014

## Skills

### Areas of Expertise

Domain adaptation, Contrastive representation learning, Adversarial training, Variational Inference, Knowledge Distillation, Score-based models

### High-level languages

Python(Expert), MatLab(Expert), C++(Fluent)

### Frameworks

PyTorch, Tensorflow, SciPy, Scikit-learning

### Cloud Platforms

AWS

## Graduate Coursework

Natural language processing, Deep probabilistic modeling, Large-scale optimization, Information theory Combinatorics & Graph theory, Statistical models for big data, Probability & stochastic process, Stochastic process, Adaptive filters, Advanced communication systems

## Selected Projects

### Domain Adaptation

PyTorch

- **Knowledge Distillation**; designed and developed a knowledge distillation framework for self-supervised contrastive learning, where the useful information from the source model drifts to the target (goal) model.
  - **Few-Shot Training**; the proposed knowledge distillation framework was modified and enhanced to transfer the source model's knowledge to the target model with very few acquired target samples, so named *Few-Max*.
  - **Verification of Efficiency**; the proposed *Few-Max* knowledge distillation scheme was scrutinized based on different source and target dataset scenarios, including from natural images (ImagNet as the source) to MRI model (as the target).
- Deliveries: [Paper](#), [Code](#)

### Robust Adversarial Training

PyTorch

- **Robust Neural Networks**; proposed a method for jointly training a provably robust classifier and detector, specifically by introducing an additional “abstain/detection” into a classifier.
  - **Verifiable Robust Networks**; innovated a pioneer scheme to extend certification techniques by considering detection to provide provable verification.
- Deliveries: [Patent](#), [Paper](#), [Code](#)

### Hyperbolic Variational Inference

PyTorch

- **Hyperbolic Graph Embedding**; demonstrated and proved that the inclusion of variational inference objective in conjunction with a hyperbolic embedding in latent space is able to capture tree-like hierarchical representation and improve quantitative metrics on downstream tasks. ([link](#))
  - **Semi-Implicit Variational Inference**; provably showed that the semi-implicit variational inference provably reduces the mutual information between the input and latent representation.
  - **Enhanced Semi-Implicit Variational Inference**; represented a method to enforce the objective function with an additional mutual information term and providing a computationally tractable approach for estimating it.
  - **Hyperbolic Adversarially Learned Inference**; ongoing project on applying hyperbolic geometry to generative adversarial networks.
- Deliveries: [Paper](#), [Code](#)

## Natural Language Processing

PyTorch, Gensim, NumPy, SciPy

- **Neural Networks for Sentiment Analysis**; implementation of feedforward (deep averaging) NNs, LSTM, and bi-directional LSTM networks by using various dimensional GloVe vectors for sentiment analysis task.
  - **Sequential CRF for Named Entity Recognition**; implementation of a CRF sequence tagger based on Viterbi algorithm for NER task.
  - **Classification for Person Name Detection**; explored and reinforced different feature extraction methods for person name detection
- Deliveries: [Code](#)

## Generative Models

Tensorflow, PyTorch, NumPy

- **InfoMax-Pixel RNN**; design and developed a new family of variation autoencoder, *InfoMax-VAE*, with Pixel RNNs and Pixel CNNs for image generation.
  - **Variational Auto-encoders (VAEs)**; the study and implementation of well-known VAE frameworks, e.g.,  $\beta$ -VAE, Info-VAE, Adversarial-VAE, Factor-VAE, MMD-VAE, Wasserstein-VAE, Pixel-CNN VAE.
  - **Generative Adversarial Networks (GANs)**; surveyed different dual representation for GANs, Info-GAN, f-GAN and Wasserstein-GAN.
  - **Text Generation**; innovated an energy-efficient spiking LSTM networks for generating new texts, word-level and character-level.
- Deliveries: [Paper-1](#), [Code-1](#), [Paper-2](#), [Code-2](#)

## Entropy and Mutual Information Estimation with Deep Networks

Tensorflow

- **Mutual Information Neural Estimation (MINE)**; the study and implementation of MINE algorithm.
  - **Variational Info-Bottleneck**; the study and implementation of variational info-bottleneck.
  - **Info-Regularizer**; mitigation of the overfitting phenomenon of deep neural networks using information-theoretic regularizer.
- Deliveries: [Code](#)

## Inference

Tensorflow, PyTorch

- **Stein Inference**; studied the theory and implementation of Stein variational gradient descent.
- **Semi-Implicit Variational Inference**; studied the theory of semi-implicit variational inference; with input as implicit random variable and a parametric variational posterior distribution.

# Experiences

---

## Robert Bosch LLC (Bosch Center for AI)

Pennsylvania, USA

MACHINE LEARNING RESEARCH INTERNSHIP

June. 2021 - Aug. 2021

- Developed a recurrent latent variable model for sensory data acquired from an electric car engine.
- Proposed a domain adaptation method to robustly model recurrent latent variables for the real-world scenario (under heavy noise from the environment).

## Robert Bosch LLC (Bosch Center for AI)

Pennsylvania, USA

MACHINE LEARNING RESEARCH INTERNSHIP

June. 2020 - Aug. 2020

- Proposed a robust adversarial training with an abstain option to improve adversarial training performance on clean images. The work has been patented. [US Patent\(17/035,203\)](#)
- Proposed verifiable adversarially trained network based on interval bound propagation. The resulting paper has been accepted at [ICLR, 2021](#).

## UT Dell Medical School

Texas, USA

MACHINE LEARNING SCIENTIST

Jan. 2020 - June 2020

- Proposed a machine learning-based approach for phenotyping pediatric patients with Asthma. The results are published at machine learning conference for healthcare, [MLHC, 2020](#).

## The University of Texas at Austin

Texas, USA

RESEARCH ASSISTANT

Aug. 2017 - PRESENT

- Ongoing project on few-shot domain adaptation for unsupervised contrastive representation learning. ([link](#))
- Completed project on extracting hierarchical representations from high-dimensional datasets. ([link](#))
- Completed project on the intersection of information theory and generative models to boost the quality of new generated samples. ([link](#))

## Sharif University of Technology

Tehran, Iran

RESEARCH ASSISTANT

Aug. 2014 - June 2017

- Reinforcement learning applications to 5G wireless communications
- Proposed a framework for 5G wireless network infrastructure planning (the results are published on IEEE transaction of vehicular technology)

## The University of Texas at Austin

Texas, USA

TEACHING ASSISTANT

Aug. 2017 - June 2018

- Probability & stochastic process/ Linear systems design & analysis

## Patents

---

F. Sheikholeslami, Z. Kolter, **A. Lotfi Rezaabad** “Method and System for Probably Robust Classification With Detection of Adversarial Examples”, *US Patent App. 17/035,203*, 2022. ([link](#))

## Publications

---

**A. Lotfi Rezaabad**, S. Kumar, S. Vishwanath, and J. Tamir, “Few-Max: Few-Shot Domain Adaptation for Unsupervised Contrastive Representation Learning”, *Preprint. Under review*. ([link](#))

**A. Lotfi Rezaabad**, R. Kalantari, S. Vishwanath, M. Zhou, and J. Tamir, “Hyperbolic Graph Embedding with Enhanced Semi-Implicit Variational Inference”, *Proceedings of The 24th International Conference on Artificial Intelligence and Statistics*, AISTATS 2021. ([link](#))

F. Sheikholeslami, **A. Lotfi Rezaabad**, and Z. Kolter, “Provably robust classification of adversarial examples with detection”, *The Ninth International Conference on Learning Representations*, ICLR 2021. ([link](#))

**A. Lotfi Rezaabad**, R. Peters, M. Sitter, A. Shende, and S. Vishwanath “Phenotyping Patients with Asthma: Preprocessing, and Clustering Algorithms” *2020 Proceedings of the 4th Machine Learning for Healthcare Conference*, August 7-8, Michigan, USA. ([link](#))

**A. Lotfi Rezaabad** and Sriram Vishwanath, “Long Short-Term Memory Spiking Networks and Their Applications”, *International Conference on Neuromorphic Systems 2020 (ICONS 2020)*. Association for Computing Machinery, New York, NY, USA, Article 3, 1–9. ([link](#))

**Ali Lotfi Rezaabad**, and Sriram Vishwanath, “InfoMax-VAE: Learning Representation by Maximizing Mutual Information in Variational Autoencoder”, *IEEE International Symposium on Information Theory (ISIT)*, CA, USA, 2020, pp. 2729-2734. ([link](#))

**A. Lotfi Rezaabad**, H. Beyranvand, J. A. Salehi, and M. Maier, “Ultra-Dense 5G Small Cell Deployment for Fiber and Wireless Backhaul-Aware Infrastructures”, in *IEEE Transactions on Vehicular Technology*, vol. 67, no. 12, pp. 12231-12243, Dec. 2018. ([link](#))

**A. Lotfi Rezaabad**, S. Talebi and A. Chizari, “Two quasi orthogonal space-time block codes with better performance and low complexity decoder,” *10th International Symposium on Communication Systems, Networks and Digital Signal Processing (CSNDSP)*, Prague, 2016, pp. 1-5. ([link](#))

V. AmiriKooshki, M. A. SadatHosseini, **A. Lotfi Rezaabad** and S. Talebi, “Performance enhancement of the Golden code by utilizing the ORIOL antenna,” *8th International Symposium on Telecommunications (IST)*, Tehran, 2016, pp. 288-292. ([link](#))