

# Ali Lotfi Rezaabad

DEEP LEARNING · INFERENCE · ADVERSARIAL TRAINING

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## Education

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

PH.D. STUDENT IN DEEP LEARNING AND INFORMATION THEORY

- Variational Inference, Adversarial Training, Generative Models, Probabilistic Modeling, Representation Learning,

Texas, USA

Aug. 2017 - PRESENT

### Sharif University of Technology, EE Department

M.SC. IN ELECTRICAL ENGINEERING, 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, COMMUNICATION SYSTEMS

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

Kerman, Iran

Aug. 2010 - June 2014

## Skills

**High-level languages** Python(Expert), MatLab(Expert), C++(Fluent)

**Frameworks** PyTorch, Tensorflow, Gensim, SciPy, NumPy, Matplotlib, Scikit-learning

## 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, Advanced communication systems, Adaptive filters

## Selected Projects

### Robust Adversarial Training

PyTorch

- Robust Neural Networks**; proposing a new method for jointly training a provably robust classifier and detector. Specifically, by introducing an additional “abstain/detection” into a classifier.
- Verifiable Robust Networks**; proposing the first method to extend certification techniques by considering detection while providing provable verification.

### Hyperbolic Variational Inference

PyTorch

- Hyperbolic Graph Embedding**; demonstrating 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
- Semi-Implicit Variational Inference**; showing that the semi-implicit variational inference provably reduces the mutual information between the input and latent representation.
- Enhanced Semi-Implicit Variational Inference**; proposing to correct the objective function with an additional mutual information term and provide a computationally tractable approach for estimating it.
- Hyperbolic Adversarially Learned Inference**; On going project on applying hyperbolic geometry to generative adversarial networks.

### Natural Language Processing

PyTorch, Gensim, NumPy, SciPy

- Neural Networks for Sentiment Analysis**; implementation of feedforward (deep averaging) NNs, LSTM, and bi-directional LSTM networks with 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**; exploring and reinforcing different feature extraction methods for person name detection

### Generative Models

Tensorflow, PyTorch, NumPy

- Variational Auto-encoders (VAEs)**; studying 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)**; studying different dual representation for GANs, Info-GAN, f-GAN and Wasserstein-GAN.
- Text Generation**; implementation of conventional and spiking LSTM networks for generating new texts, word-level and character-level.
- Pixel RNN**; implementation of Pixel RNN and Pixel CNN for image generation.

### Entropy and Mutual Information Estimation with Deep Networks

Tensorflow

- Mutual Information Neural Estimation (MINE)**; studying and implementation of MINE algorithm.
- Variational Info-Bottleneck**; studying and implementation of variational info-bottleneck.
- Info-Regularizer**; mitigating the overfitting of deep neural networks using information-theoretic regularizer.

## Inference

Tensorflow, PyTorch

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

- Check my [github](#) account for the codes.

## Experiences

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### Robert Bosch LLC

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 results are filed as an inventory report.
- Proposed verifiable adversarially trained network based on interval bound propagation. The resulting paper has been accepted at ICLR 2021 ([link](#)).

### 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 ([link](#)).

### The University of Texas at Austin

Texas, USA

RESEARCH ASSISTANT

Aug. 2017 - PRESENT

- Ongoing work on extracting hierarchical representations from high dimensional datasets
- Ongoing work on the intersection of information theory and generative models (adversarial networks and variational autoencoders)

### 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

## Publications

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**Ali Lotfi Rezaabad**, R. Kalantari, S. Vishwanath, M. Zhou, and J. Tamir, "Hyperbolic Graph Embedding with Enhanced Semi-Implicit Variational Inference", *accepted as a conference paper at AISTATS 2021* ([link](#)).

F. Sheikholeslami, **Ali Lotfi Rezaabad**, and Z. Kolter, "Provably robust classification of adversarial examples with detection", *accepted as a conference paper at ICLR 2021* ([link](#)).

F. Sheikholeslami, Z. Kolter, and **Ali Lotfi Rezaabad**, "METHOD AND SYSTEM FOR PROBABLY ROBUST CLASSIFICATION WITH DETECTION OF ADVERSARIAL EXAMPLES", *Filed for US patent*.

**Ali 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](#)).

**Ali 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.

**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.

**Ali 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.

**Ali 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.

V. AmiriKooshki, M. A. SadatHosseini, **Ali 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.

## Honors

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| 2016 | <b>Honored Alumnus</b> , Class of 2016, Sharif University of Technology                                  | <i>Tehran, Iran</i> |
| 2014 | <b>Ranked 5th</b> , among more than <b>42000</b> participators in M.Sc National Entrance University Exam | <i>Iran</i>         |
| 2014 | <b>Ranked 1st</b> , among <b>120</b> students, class of 2010, Shahid Bahonar University of Kerman        | <i>Kerman, Iran</i> |