

Ali Lotfi, Ph.D.

NLP - MACHINE LEARNING

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Education

The University of Texas at Austin, ECE Department

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

Texas, USA

Aug. 2017 - Jan. 2023

- Contrastive Learning, NLP, Transfer Learning, Knowledge Distillation, Generative Models, Adversarial Training

Sharif University of Technology, EE Department

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

Tehran, Iran

Aug. 2014 - June 2016

- Optimization, Millimeter Wave Cellular Networks, Wireless Communication Systems

University of Kerman, EE Department

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

Kerman, Iran

Aug. 2010 - June 2014

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

Experiences

Bank of America

Plano, USA

DATA SCIENTIST - ERICA TEAM (FULL-TIME)†

May 2023 - Present

- Developed an internal Large Language Model (LLM) from scratch to process specialized banking data.
- Developed a contrastive learning layer into a custom language model encoder to differentiate between high-quality and low-quality labels.
- Created a contrastive learning layer for a language model encoder, enhancing review labeling accuracy in noisy data for Bank of America's project.
- Designing a specialized drift detector using the internal LLM, improving the bank's data analysis and processing functions.
- Designing a model based on the internally-developed LLM to efficiently classify and route chat customer inquiries.

†Contractor through Signature Consultants

The University of Texas at Austin

Texas, USA

GRADUATE RESEARCH ASSISTANT (FULL-TIME)

Aug. 2017 - Feb 2023

- Completed a project focused on few-shot domain adaptation techniques in the realm of unsupervised contrastive learning. ([link](#))
- Completed a project aimed at deriving hierarchical structures from complex, high-dimensional data sets. ([link](#))
- Concluded a project exploring the synergy between information theory and generative models to enhance and diversify generated samples. ([link](#))

Robert Bosch LLC (Bosch Center for AI)

Pennsylvania, USA

MACHINE LEARNING RESEARCHER (INTERNSHIP)

June. 2021 - Aug. 2021

- Created a recurrent latent variable model to analyze sensor data from an electric vehicle's motor.
- Proposed a domain adaptation method to robustly model recurrent latent variables in a noisy setting.

Robert Bosch LLC (Bosch Center for AI)

Pennsylvania, USA

MACHINE LEARNING RESEARCHER (INTERNSHIP)

June. 2020 - Aug. 2020

- Proposed a simple yet effective method to enhance the effectiveness of neural networks that are trained to resist adversarial attacks. The work has been patented; [US Patent\(17/035,203\)](#)
- Proposed and published certifiable adversarially-trained network using interval bound propagation. The corresponding article has been accepted at [ICLR, 2021](#).

UT Dell Medical School

Texas, USA

RESEARCH ASSISTANT (FULL-TIME)

Jan. 2020 - June 2020

- Proposed a machine learning approach for the phenotyping of pediatric asthma patients. The findings were presented at a healthcare-focused machine learning conference; [MLHC, 2020](#).

Skills

Areas of Expertise

Natural language processing, LLM, Transformers, Domain adaptation, Knowledge Distillation, Contrastive learning, Variational Inference, Distributed Training

High-level languages

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

Frameworks

PyTorch, Transformers, Tensorflow, SciPy, Gensim, NLTK, spaCY, Pandas, Scikit-learning, Deep Java Library

Cloud Platforms

AWS, Colab

Professional Services

Instructor

USA

EDX - 2U

- Delivered comprehensive lectures on Statistics, Machine Learning, and Deep Learning, emphasizing Predictive Analytics and Data Visualization.
- Educated students on critical algorithms such as Regression, Clustering, and Decision Trees, ensuring clear understanding.
- Provided hands-on training in essential data science libraries including Scikit-Learn, Pandas, TensorFlow, Keras, Matplotlib, and SciPy.

Reviewer

ICML, ICLR, Neurips, AISTATS, InfoComm, ICC, IEEE Transaction on Communication

Selected Projects

Natural Language Processing

PyTorch, Transformers, spaCY, Gensim, NLTK

- **Custom Large Language Model:** Developed a custom large language model (LLM) from the ground up. This project aimed to create a unique solution optimized for banking data that outperforms industry benchmarks such as RoBERTa and BERT in terms of performance metrics. (BofA)
 - **Contrastive Learning Solution:** Developed a contrastive learning layer into a custom language model encoder to effectively differentiate between high-quality and low-quality labels in an intent classification project. This innovative approach significantly enhanced the accuracy of the model in a noisy data set. (BofA)
 - **Request Classification:** Leveraged the internally developed LLM to optimize the classification and routing of customer inquiries via chat; led to streamlined customer support operations and enhanced response efficiency. (BofA)
 - **Drift Detector:** Engineered and trained a specialized drift detection algorithm utilizing the internal LLM. This innovation substantially elevated the bank's data analysis capabilities and optimized its data processing workflows. (BofA)
 - **Named Entity Recognition:** Explored and reinforced different feature extraction methods for person name detection. (UT Austin)
- Public Deliveries: [Code](#)

Domain Adaptation

PyTorch

- **Knowledge Distillation:** Proposed and developed a framework for knowledge distillation that focuses on self-supervised contrastive learning, enabling the transfer of valuable insights from the source model to the target model.
 - **Few-Shot Training:** Suggested an approach leveraging the proposed Knowledge Distillation (KD) framework to convey the expertise from the source model to the target model, despite having a minimal number of target samples.
 - **Verification of Efficiency:** the proposed *Few-Max* knowledge distillation scheme was scrutinized based on different source and target dataset scenarios, including natural images (ImagNet as the source) to MRI model (as the target).
- Deliveries: [Paper](#), [Code](#)

Robust Adversarial Training

PyTorch

- **Robust Neural Networks:** Introduced a technique for the simultaneous training of a classifier and detector that is provably robust; achieved by adding an "abstain/detection" category to the classifier.
 - **Verifiable Robust Networks:** Devised a pioneer approach that expands certification methods by incorporating detection features to offer verifiable assurance.
- Deliveries: [Patent](#), [Paper](#), [Code](#)

Hyperbolic Variational Inference

PyTorch

- **Hyperbolic Graph Embedding:** demonstrated and proved that combining variational inference objectives with hyperbolic embedding in latent space enhances tree-like hierarchical representation and boosts performance metrics in subsequent tasks. ([link](#))
 - **Semi-Implicit Variational Inference:** Demonstrated, with mathematical rigor, that the application of semi-implicit variational inference effectively diminishes the mutual information between the input and the latent representation.
 - **Enhanced Semi-Implicit Variational Inference:** Formulated a methodology that augments the objective function with an additional term for mutual information, while also offering a computationally efficient strategy for its estimation.
- Deliveries: [Paper](#), [Code](#)

Generative Models and Mutual Information

Tensorflow, PyTorch, NumPy

- **InfoMax-Pixel RNN:** design and developed a new family of variation autoencoders, *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., β -VAE, Info-VAE, Adversarial-VAE, Factor-VAE, MMD-VAE, Wasserstein-VAE, Pixel-CNN VAE.
 - **Info-Regularizer:** mitigation of the overfitting phenomenon of deep neural networks using information-theoretic regularizer.
- Deliveries: [Paper-1](#), [Code-1](#), [Paper-2](#), [Code-2](#)

Entropy and 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.
- Deliveries: [Code](#)

- **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.

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](#))

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