Mohammadreza Alimohammadi

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Research Interests

- Distributed Machine Learning
- Information Theory
- Privacy and Fairness
- High Dimensional Statistics
- Theory of Machine Learning
- Optimization

Education

Sharif University of Technology, Tehran, Iran — Sep. 2018 - Expected Aug. 2023

B.Sc. in Electrical Engineering

B.Sc. in Mathematics and Applications

- GPA: 18.99/20 (US scale: 4.0/4), ranked 10^{th} among 170+ students (as of September 2022)
- GPA in Major Subjects: EE: 18.97/20, Math: 19.30/20 (as of September 2022)

Allameh Helli High School, Affiliated with National Organization for Development of Exceptional Talents (NODET), Tehran, Iran — Sep. 2014 - May 2018

Diploma degree in Mathematics and Physics

Publications

◇ A. Yadav†, **M. Alimohammadi**†, Y. Zhang, A. Budkuley, S. Jaggi, **New Results on AVCs With Omniscient and Myopic Adversaries**. In *IEEE International Symposium on Information Theory* (***ISIT***), 2022. Presentation - Slides

◇ **M. Alimohammadi**†, I. Markov†, D. Alistarh, **L-GreCo: A Framework for Layerwise Adaptive Gradient Compression**, To be submitted to *Conference on Machine Learning and Systems* (*MLSys*), 2023. (Working paper)

†: Equal Contribution

Selected Research Experiences

Distributed Algorithms and Systems Laboratory, IST Austria — Klosterneuburg - Austria

Research Intern - Supervisor: Prof. Dan Alistarh — *Feb 2022 – Present*

◇ **L-GreCo: A Framework for Layerwise Adaptive Gradient Compression**

I am worked on optimal gradient compression in distributed training of neural networks. Our proposed algorithm, called L-GreCo, uses dynamic programming to find the optimal layer-wise compression. L-GreCo preserves the model accuracy while providing training-time speed-ups under different compression schemes on multiple tasks and architectures. I am currently working towards submission to *MlSys* 2023.

◇ **LRSPDY: Low-Rank Decomposition with Speedup Guarantees**

I am working on combining various low-rank decomposition techniques with an algorithm that automatically determines layer-wise compression levels in neural networks to achieve a target inference speed-up on a given system.

◇ **Loseless Adaptive Gradient Compression**

I am working on a real-time adaptive algorithm that determines the lossless compression based on a composite loss resulting from combining layer-wise compression errors and the number of parameters of the model.

CAN-DO-IT research group, University of Bristol — Bristol - England

Research Intern - Supervisor: Prof. Sidharth Jaggi — *Jul 2021 – Feb 2022*

◇ **New Results on AVCs With Omniscient and Myopic Adversaries**

I worked on communication channels in the presence of myopic adversaries. We extended the well-known Elias-Bassalygo upper bound to this regime, resulting in a paper accepted for presentation at ISIT 2022. Here are links to my presentation, and slides at *ISIT* 2022.

Bachelor Thesis, Sharif University of Technology — Tehran - Iran

Bachelor Thesis - Supervisor: Prof. Mohammad Hossein Yassaee — *Jul 2022 – present*

◇ **Understanding The Interplay between Privacy, Communication, and Utility in Federated Learning**

Edge Machine Learning Research Group, Sharif University of Technology — Tehran - Iran

Research Assistant - Supervisor: Prof. Mohammad Ali Maddah-Ali — *Dec 2020 – Sep 2021*

◇ **Learning at The Edge**

To make models runnable on edge devices with limited resources, I used low-rank representation techniques to reduce the neural network's inference time and memory requirement.

Honors and Awards

Mathematical Olympiad Silver Medal in Iran National Mathematical Olympiad *Sep. 2017*

Iranian University Entrance Exam (Konkur) Ranked 123^{th} among 144000 participants *Jul. 2018*

Selected Courses and Course Projects

Graduate Courses

- High Dimensional Statistics [19.9/20]
  - Project: Differential Privacy & Learning Relationship.
- Information Theory Methods in ML and Stats [18.6/20]
  - Project: Differential Privacy & IT Relationship.
- Deep Learning [18.5/20]
  - Project: Joint Depth Estimation & Object Detection.
- Convex Optimization [20.0/20]
  - Project: Linear Programming Solver in MATLAB.
- Blockchain Technology [20.0/20]
  - Project: A Study on Gasper protocol.
- Algorithmic Game Theory [18.6/20]
  - Project: Reinforcement Mechanism Design.
- Stochastic Analysis [19.5/20]
- Real Analysis [19.0/20]
- Advanced Theory of Statistics [in progress]
- Data Communication Networks [in progress]

Undergraduate Courses

- Combinatorial Optimization
- Foundations of Neuroscience
- Machine Learning
- Algorithm Design
- Graph Theory
- Analytic Number Theory
- Applied Linear Algebra
- Abstract Algebra
- Advanced Programming
- Signals and Systems
- Cryptography
- Stochastic Processes

Selected Teaching Experiences

Teaching Assistant, Sharif University of Technology

- High Dimensional Statistics†
- Convex Optimization
- Linear Algebra
- IT Methods in ML and Stats†
- Algorithm Design
- Probability and Statistics
- Deep Learning†
- Machine Learning
- C Programming

†: Graduate Course

Selected Working Experience

Intern @ NamaKav: Working on Efficient Methods to Search for a Video in a Database. *Sep. 2022 – Present*

Scientific Advisor @ Resana: Sharif EE Department Cultural and Scientific Student Organization *Jun. 2020 – Jun. 2021*

Skills

Programming Skills: Python | Julia | Java | C/C++ | MATLAB | Git | bash

Machine Learning Frameworks: Pytorch (*Advanced*) | TensorFlow

Language Skills: Persian (*mother tongue*) | English (*full professional proficiency, TOEFL Score 102*)

References

Prof. Dan Alistarh dan.alistarh@ist.ac.at
Professor, CS Department, Institute of Science and Technology Austria (IST Austria)

Prof. Sidharth Jaggi sid.jaggi@bristol.ac.uk
Associate Professor, School of Mathematics, University of Bristol

Prof. Mohammad Hossein Yassaee yassaee@sharif.edu
Assistant Professor, EE Department, Sharif University of Technology

Prof. Mohammad Ali Maddah-Ali maddah@umn.edu
Associate Professor, ECE Department, University of Minnesota Twin Cities

Please refer to my personal website for more information