

SHAHRZAD KIANIDEHKORDI

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EDUCATION

- **Ph.D. in Communications (Federated Learning)**, GPA: 3.94/4 Sep 2019 - Present
MASc. in Communications (Distributed Coded Computation), GPA: 3.74/4 2017 - 2019
University of Toronto (UofT), Department of Electrical and Computer Engineering (ECE)
- **B.Sc. in Electrical Engineering (Digital Systems)**, GPA: 17.4/20 2012 - 2017
Sharif University of Technology (SUT), Department of Electrical Engineering
Minor in Economics, GPA: 17.4/20
SUT, Department of Management and Economics
- **Certified at International High-Performance Computing Summer School** July 2019
RIKEN Center for Computational Science(R-CCS) and Kobe University, Kobe, Japan

TECHNICAL SKILLS

- Experience with operating systems: **Linux** and **Microsoft Windows**, and with distributed version control systems: **GIT** and **Mercurial**. Skillful in documentation using **L^AT_EX** and **Microsoft Office**.
- Proficiency in scripting languages: **Python** and **MATLAB**, in programming language: **C++**, and also familiarity with **C**, **Java**, and **Julia**. Knowledge of the hardware description language **Verilog**.
- Ability to use and conduct programming on cloud services and high-performance computing systems such as **Compute Canada** and **Amazon EC2**.
- Knowledge of **parallel/multi-thread** programming, and basic familiarity with **GPU** programming
- Familiar with deep learning frameworks: **PyTorch** and **TensorFlow** during graduate courses.

RESEARCH AND WORK EXPERIENCES

- **Machine Learning Researcher, Intern** Summer 2021
Accelerated Neural Technology (Ant) Team, Noah's Ark Lab, Huawei Technologies Co., Montreal
 - Formulated novel theories in floating point arithmetic for training large neural network (NN) models.
 - Studied acceleration techniques used in training NN, and developed skills in Pytorch programming.
- **Graduate Research Assistant** 2017 - Present
UofT, Multimedia Processing Lab, Supervisor: Prof. Stark C. Draper
 - **MASc thesis:**
 - * Developed novel methods for coded distributed computing (CDC) that arbitrages ideas from coding theory into distributed systems to mitigate the stragglers effect.
 - * Help to accelerate large-scale matrix multiplication by exploiting both stragglers and fast nodes.
 - * Developed order-statistics analysis, evaluated our techniques using Monte Carlo simulations with MATLAB, and compared our results with the state-of-the-art techniques on Amazon EC2 using Parallel Programming with MPI (message passing interface) in Python and C++.
 - **First Ph.D. project:** (built upon my UofT master's thesis and my training in the 2019 IHPCSS)
 - * Combined ideas from approximate computing with CDC to further accelerate computation.
 - * Developed rate-distortion analogs for CDC in which there are multiple stages of recovery en route to exact recovery. Motivated by applications in optimization and learning where an exact matrix product is not required and one would prefer to get a lower-fidelity result faster.
 - * Examined the various sources of error that affect the computations, including numerical errors due to finite precision and errors due to approximation, plus conducted simulations in python to benchmark our designed method against related works.
 - **Current Ph.D. project:**
 - * Conduct research in the field of private and personalized federated learning for around 1/5 year.
 - * Develop novel methods for personalized federated learning to address the issue of heterogeneous data. Privatize our method using techniques from differential privacy.
 - * Have been motivated by pre-existing physical or social interactions amongst clients that group clients by their updating rules and privacy policies.

- **Student in IHPCSS' 2019** July 2019
 - This week-long, expenses-paid program brought together mentors/students whose research can benefit from HPC and provided training in parallel and GPU programming and data-intensive computing. It also provided networking opportunities with experts from SciNet, PRACE, XSEDE, and R-CCS.
- **Undergraduate Research Intern** July 2015-Sep 2015
Chinese University of Hong Kong (CUHK), Department of Info. Eng., Supervisor: Prof. Chandra Nair
 - Studied fundamental open problems in network information theory with a focus on modeling achievable regions for particular communications channels. Focused on developing new inequalities and simulations for pursuing explicit computations of inner and outer bounds.
- **Undergraduate Research Assistant** 2015-2017
SUT, Image and Multimedia Processing Lab, Supervisor: Prof. Farokh Marvasti
 - Participated in Signal Processing Cup 2015 as a member of a group of three math Olympiad winners and a Ph.D. student. Our results, in terms of accuracy, ranked 1st nationally and 8th internationally.
 - Focused on the problem of heart rate tracking using PPG and 3D acceleration signals, recorded from the wrist. Proposed a novel motion artifacts cancellation method to estimate a higher resolution spectrum of PPG signals.

PUBLICATIONS

- 1 **S. Kiani** and S. Draper, "Successive approximated coded matrix multiplication," in *IEEE J. Selected Areas in Inf. Theory (JSAIT)*, 2022.
- 2 **S. Kiani** and S. Draper, "Successive approximated coded matrix multiplication," in *IEEE Int. Symp. Inf. Theory (ISIT)*, Espoo, Finland, Jun 2022.
- 3 **S. Kiani**, T. Adikari, and S. Draper, "Hierarchical Coded Elastic Computing," in *IEEE Int. Conf. on Acoustics, Speech, and Signal Processing (ICASSP)*, Toronto, ON, Canada, May 2021.
- 4 **S. Kiani**, N. Ferdinand, and S. Draper, "Hierarchical Coded Matrix Multiplication," in *IEEE Trans. Inf. Theory (TIT)*, 2020.
- 5 **S. Kiani**, N. Ferdinand, and S. Draper, "Cuboid Partitioning for Hierarchical Coded Matrix Multiplication," in workshop on Coded ML, *IEEE Int. Conf. Machine Learning (ICML)*, 2019.
- 6 **S. Kiani**, N. Ferdinand and S. Draper, "Hierarchical Coded Matrix Multiplication," in *IEEE Canadian Workshop on Inf. Theory (CWIT)*, Hamilton, ON, Canada, Jun 2019.
- 7 S. Sadrizadeh, **S. Kiani**, M. Boloursaz, F. Marvasti, "Iterative Method for Simultaneous Sparse Approximation," in *Scientia Iranica, Transaction D: Computer Science and Electrical Engineering*, 2019.
- 8 **S. Kiani**, N. Ferdinand and S. Draper, "Exploitation of Stragglers in Coded Computation," in *IEEE Int. Symp. Inf. Theory (ISIT)*, Vail, Colorado, Jun 2018.
- 9 M. Boloursaz, M. Eskandari, E. Asadi, **S. Kiani**, F. Marvasti, "Heart Rate Tracking Using Wrist-Type Photoplethysmographic (PPG) Signals during Physical Exercise with Simultaneous Accelerometry," in *IEEE Signal Processing Letters (SPL)*, 2016.

TALKS AND PRESENTATIONS

- "Successive approximated coded matrix multiplication"
 - presented as a conference paper at *ISIT*, Espoo, Finland, Jun 2022.
 - presented as a poster in *Munich Workshop on Coding and Cryptography*, Germany, Jun 2022.
- "Hierarchical Coded Elastic Computing,"
 - presented as a conference paper at *ICASSP*, Toronto, ON, Canada, May 2021.
- "Hierarchical Coded Matrix Multiplication,"
 - presented as a conference paper at *CWIT*, Hamilton, ON, Canada, Jun 2019.
 - presented as a poster in *Alumni Machine Intelligence Bootcamp' 18*, in *Computing Hardware for Emerging Intelligent Sensory Applications (COHESA) AGM 19*, and in 2019 *IHPCSS*, Japan.

SELECTIVE GRADUATE COURSES

- System Modeling and Analysis (A+)
- Statistical Methods for ML and Data Mining (A+)
- Learning to Search: Current ML Algorithms (A+)
- Introduction to Statistical Learning (A)
- Convex Optimization (A-)
- Algorithm and Data Structure (A-)
- Detection and Estimation (A)
- Random Processes (A+)
- Error Control Codes (A)

AWARDS AND HONORS

- **Gold** medal in National Mathematical Olympiad in Iran 2011
- **8th** place in IEEE Signal Processing Cup 2015 among 60 teams 2015
- Accepted into CUHK competitive internship, granted with full scholarships 2015
- Accepted into the IHPCSS in Japan, granted with full scholarship. July 2019
- Winner of **Ontario Graduate Scholarship (OGS)** for two consecutive years. 2019-2021
- Winner of **DiDi graduate award** for three consecutive years. 2020-2023
- **NSERC Scholar**, Alexander Graham Bell Graduate Scholarship-Doctoral (CGS D3). 2021-2024
- Recipient of University of Toronto student and research fellowship. 2017-Present

TEACHING AND MENTORING EXPERIENCES

- *Teaching assistant* in “*Algorithms and Data Structures*” (ECE1762) at UofT. Winter’23
- *Teaching assistant* in “*Advanced Engineering Maths.*” (MAT290) at UofT. Fall’19,’20,’21,’22
- *Teaching assistant* in “*Signal and Systems*” (ECE216) at UofT. Winter’19,’20,’22
- *Teaching assistant* in “*Algorithm Design, Analysis and Complexity*” (CSC373) at UofT. Fall’20
- *Mentoring* an undergraduate student who got involved in the Co-op program at NVIDIA. 2019
- *Teaching assistant* in “*Matrix Algebra and Optimization*” (ECE367) at UofT. Fall’18
- *Teaching assistant* in “*Principles of Electronics*” at SUT. Fall’16
- *Olympiad Mathematical Teacher* in Farzanegan 1&3 High School, Tehran, Iran. 2012 - 2016

PROFESSIONAL SERVICES AND ACTIVITIES

- **Reviewing** services 2012 - Present
 - *Journals*: IEEE Trans. Inf. Theory, IEEE J. Selected Areas in Inf. Theory, IEEE Trans. Commun, IEEE Trans. Signal processing.
 - *Conference and workshop*: IEEE Inf. Theory Workshop, IEEE Int. Symp. Inf. Theory.
- *Question Designer, Corrector and Referee* in the high school student competition at SUT. 2014
- *Assembling and commissioning an automatic direction finder robot* in Sharif Cup at SUT. 2013

SELECTED ACADEMIC PROJECTS

- “*Image de-bluring*”, “*Optical Character Recognition (OCR)*”, and “*Audio echo cancellation*” implemented in Matlab. SUT Course: Signals and Systems.
- “*Segmentation (image processing)*”, “*HR measurement (video processing)*”, “*Digital image de-noising*”, and “*Digital image segmentation*” implemented in Matlab. SUT Course: Digital Signal Processing.
- “*Feature extraction and classification of EEG signal using neural network*” implemented in Matlab. SUT Course: Artificial Intelligence and Biological Computation.
- “*Snake video game*” coded in C++ using Pthread. SUT Course: Advanced Programming.
- “*Developing a simple communication protocol in order to design and implement SMS transfer system*” developed on an android-based platform using JAVA. SUT Course: Data Networks.
- “*JPEG image compression*” implemented in HDL and Matlab. SUT Course: ASIC/FPGA Design.
- “*Improved seizure detection and prediction using machine learning*” implemented in Python - TensorFlow. UofT Course: ECE1504 - Statistical Learning.
- “*Hierarchical coded matrix multiplication*” implemented in matlab. UofT Course: ECE1505 - Convex Optimization.
- “*Long Text Generation with Structural Reader and Adversarial Discriminator,*” UofT Course: CSC2547 - Learning to Search.

RESEARCH INTERESTS

- Distributed computing, Coding theory, Statistical learning, Data privacy

LANGUAGE SKILLS

- *Persian*: native, *English*: fluent, *German*: elementary