Tahseen W. Rabbani

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Overview

- I am interested in **efficient training** strategies for large-scale machine learning, with an emphasis on **federated/distributed** learning. My work often involves elements of **model compression, faster computation, and privacy** – AI/ML for user-driven, resource-constrained clients.
- Comfortable with Python (PyTorch, TensorFlow, Scikit-learn), HPC, and OpenMPI.

Education

University of Maryland College Park, MD, U.S.A. • Ph.D. Student, Fall 2018 - Present

Areas:

- Spring 2019 - Present: Computer Science Ph.D. Program
- Fall 2018 - Fall 2019: Mathematics Ph.D. Program

New York University New York City, NY, U.S.A. • Master's Program in Mathematics, Fall 2017 - Spring 2018 (non-degree)

GPA: 3.81/4.00

Activities:

- Co-creator of the Courant Math. Sciences Seminar for Master's Students.

University of Virginia Charlottesville, VA, U.S.A. • Bachelor of Arts in Mathematics, Class of 2015

GPA: 3.81/4.00 (Major), 3.64/4.00 (Cumulative)

Publications

Conference & Journal

1. **T. Rabbani***, M. Bornstein*, & F. Huang. "Large-Scale Distributed Learning via Private On-Device Locality-Sensitive Hashing." *Advances in Neural Information Processing Systems.* (*NeurIPS 2023*)
2. M. Bornstein*, **T. Rabbani***, E. Wang, A. Singh, & F. Huang. "SWIFT: Rapid Decentralized Federated Learning via Wait-Free Model Communication." *The Eleventh International Conference on Learning Representations. (ICLR 2023).*
3. T. Applebaum, J. Clickeman, J. Davis, J. Dillon, J. Jedwab, **T. Rabbani**, K. Smith, & W. Yolland. "Constructions of difference sets in nonabelian 2-groups." *Journal of Algebra & Number Theory.*, Vol. 17, **2** (2023).
4. M. Ding*, **T. Rabbani***, B. An, E. Wang, & F. Huang. "Sketch-GNN: Efficient GNNs with Graph Size-Independent Scalability." *Advances in Neural Information Processing Systems.* (*NeurIPS 2022)*
5. **T. Rabbani***, A. Rajkumar, & F. Huang. "Practical and Fast Momentum-Based Power Methods." *Mathematical and Scientific Machine Learning.* PMLR, Vol. 145 (2021).
6. F. Huang*, **T. Rabbani***, & A. Reustle*. "Fast GPU Convolution for CP-decomposed Tensorial Neural Networks," *Proceedings of SAI Intelligent Systems Conference.* (2020)
7. K. Smith and **T. Rabbani**. "Nonabelian Orthogonal Building Sets," *Proceedings of FQ14: The 14th International Conference on Finite Fields and their Applications.* (2020)
8. **T. Rabbani***. "Unique minimal forcing sets and forced representation of integers by quadratic forms," *Rose-Hulman Undergraduate Journal of Mathematics*, Vol. 17, **1** (2016).
9. **T. Rabbani***. "Improving the Error-Correcting Code Used in 3-G Communication," *SIAM Undergrad. Research Online (SIURO)*, **8** (2015), 126-137.

Workshop

1. **T. Rabbani***, M. Bornstein*, F. Huang. "PGHash: Large-Scale Distributed Learning via Private On-Device Locality-Sensitive Hashing." *ICLR 2023 Workshop on Sparsity in Neural Networks.*

2. **T. Rabbani***, J. Su*, X. Liu, D. Chan, G. Sangston, & F. Huang. "conv_einsum: A Framework for Representation and Fast Evaluation of Multilinear Operations in Convolutional Tensorial Neural Networks." *Third Workshop on Seeking Low-Dimensionality in Deep Neural Networks.* (2023)

3. (Spotlight) M. Bornstein*, **T. Rabbani***, E. Wang, A. Singh, & F. Huang. "SWIFT: Rapid Decentralized Federated Learning via Wait-Free Model Communication." *International Workshop on Federated Learning: Recent Advances and New Challenges in Conjunction with NeurIPS 2022 (FL-NeurIPS'22).*

4. M. Ding, X. Liu, **T. Rabbani**, & F. Huang. "Faster Hyperparameter Search on Graphs via Calibrated Dataset Condensation." *NeurIPS 2022 Workshop: New Frontiers in Graph Learning.*

5. (Spotlight) **T. Rabbani***, B. Feng*, Y. Yang, A. Rajkumar, A. Varshney, & F. Huang. "Comfetch: Federated Learning of Large Networks on Memory-Constrained Clients via Sketching." *International Workshop on Trustable, Verifiable and Auditable Federated Learning in Conjunction with AAAI 2022 (FL-AAAI-22).*

Preprint

1. B. An*, M. Ding*, **T. Rabbani***, A. Agrawal, C. Deng, Y. Xu, S. Zhu, A. Mohamed, Y. Wen, T. Goldstein, F. Huang. "Benchmarking the Robustness of Image Watermarks." (2023)

2. **T. Rabbani***, K. Sang*, F. Huang. "Balancing Extreme Label-Imbalance in Federated Environments Using Mixup and Natural Noise." (2023)

3. M. Ding*, Y. Xu*, **T. Rabbani**, X. Liu, B. Gravelle, T. Ranadive, T.C. Tuan & F. Huang. "Calibrated Dataset Condensation for Faster Hyperparameter Search." (2023)

Awards, Grants, & Nominations

2023 RSA Conference 2024 Security Scholar

2023 Qualcomm Innovation Fellowship 2023, Abstract Selection, *"SWIFT: Scalable Implementation of On-Device Asynchronous Decentralized Federated Learning."*

2022 Apple Scholars in AI/ML Nominee (Univ. of Maryland).

2022 ICSSA and Jacob K. Goldhaber Travel Grant (Univ. of Maryland). **Topic:** "On enumeration and computational construction of groups of order 1024."

2020-2021 COMBINE Fellowship (**$34,000**, NSF DGE-1632976)

2019 NSF GRFP Honorable Mention.

2019 Spotlight on Grad. Research: Seymour Goldberg Memorial Award. Univ. of Maryland.

2015 Distinguished Majors Program (**High Distinction**). Univ. of Virginia. Thesis: *p-adic Numbers and the Hasse-Minkowski Theorem.*

2015 Small Research and Travel Grant (**$636**, Univ. of Virginia). **Topic**: "3-G Error-Correcting Codes."

2014 Research Grant (**$2500**, Provost's Office and Dept. of Mathematics). **Topic**: "Integer representation by quadratic forms." Univ. of Virginia.

2013 Small Research and Travel Grant (**$480**, Univ. of Virginia). **Topic**: "Existence criteria of Hadamard difference sets."

2012-2015 Echols Scholar. University of Virginia.

Employment

Error Corp. (Washington, DC., Jan 2023 - Present)
Machine Learning Research Scientist

- My work is concerned with learning error-correcting codes and controls for quantum systems. Developing and analyzing the theoretical properties of novel product constructions.

University of Maryland (College Park, MD, Jan. 2018 - Present)
Graduate Research Assistant

- Advisor: Dr. Furong Huang. My research projects have ranged over tensorial neural networks, federated learning, graph neural networks, dimensionality-reduction, spectral methods, and generative watermarking.

Georgetown University (Washington, DC, Fall. 2021 - Fall 2023)
Adjunct Lecturer

- Adjunct faculty member, course: MATH035: Calculus 1.

MileMarker (Johns Hopkins University, Baltimore, MD, June 2022 - Nov 2022)
Data Science & ML Intern

- Successfully developed a series of temporally-dependent models able to predict future performance of a surgical resident. Areas: Few-shot learning and explainable ML.

Epic Systems (Madison, WI, Sep. 2015 - May 2017)
Software Developer

- Developed a series of applications concerned with the preservation of database pointers during digital exchange of electronic medical records between hospitals.

Teaching & Service

Reviewer (2021-Present) NeurIPS, ICLR, ICML, ICASSP, AISTATS, MSML, IEEE TPDS.

FL@FM-NeurIPS23 Program Committee Member.

FL-ICML-23 Program Committee Member.

FL-NeurIPS-22 Program Committee Member.

Fall 2020 - Fall 2021 University of Maryland, COMBINE Director of Undergraduate Research

Spring 2020 University of Maryland, Discrete Data Structures, Teaching Assistant (No rating)

Fall 2019 University of Maryland, Calculus 1, Teaching Assistant (Rating: 3.64/4.00)

Spring 2019 Directed Reading Program. Student: Samuel Howard. Topic: Error-Correcting Codes

Spring 2019 University of Maryland, Calculus 1, Teaching Assistant (Rating: 3.80/4.00)

Fall 2018 University of Maryland, Calculus 1, Teaching Assistant (Rating: 3.59/4.00)

Spring 2018 New York University, Math. of Econ II, Recitation Leader

Spring 2018 New York University, Abstract Algebra, Grader

Talks

Jan 2023 Abu Dhabi, UAE @ MBZUAI. Seeking Low Dimensionality in Deep Neural Networks (SlowDNN). "Fast Evaluation of Multilinear Operations in Convolutional Tensorial NNs."

Nov 2022 New Orleans, LA. FL-NeurIPS'22. "SWIFT: Rapid Decentralized Federated Learning via Wait-Free Model Communication."

Nov 2022 New Orleans, LA. GLFrontiers (with NeurIPS 2022). "Sketch-GNN: Efficient GNNs with Graph Size-Independent Scalability."

Nov 2022 New Orleans, LA. GLFrontiers (with NeurIPS 2022). "Faster Hyperparameter Search for GNNs via Calibrated Dataset Condensation."

June 2022 Mantua, Italy. Combinatorics 2022, "49,487,367,289: On enumeration and computational construction of groups of order 1024."

March 2022 FL-AAAI-22 (Virtual), "Comfetch: Federated Learning of Large Networks on Memory-Constrained Clients via Sketching."

August 2021 MSML21 (Virtual), "Practical and Fast Momentum-Based Power Methods."

June 2019 Vancouver, BC. Finite Fields Conference (FQ14), "New Constructions of Hadamard Difference Sets."

April 2019 Monroe L. Martin Spotlight Talks (Winner), Univ. of Maryland.

Oct. 2017 New York University, Master's Learning Seminar, "The Sum of Squares and Universal Quadratic Forms."

Jan. 2015 San Antonio, TX. Joint Mathematics Meeting, MAA Poster Sesssion, "Improving the Error-Correcting Code Used in 3-G Communication."

Jan. 2014 Baltimore, MD. Joint Mathematics Meeting, MAA Poster Session, "Bent Functions and Difference Sets."