

# TAHSEEN W. RABBANI

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## OVERVIEW

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- 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

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**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

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\* = First author

### 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

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**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

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**Error Corp.** (Washington, DC., Jan 2023 - Present)

***Machine Learning Quantum Research Scientist***

- My work is concerned with learning quantum error-correcting codes and controls. I am 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.

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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

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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 Session, “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.”