Marco Bornstein

My overarching research goal is to make edge and distributed learning algorithms more realistic, efficient, and secure

Georgetown, Washington, DC | +1 (206) 495-3942 | marco.i.bornstein@gmail.com

SELECTED RESEARCH EXPERIENCE

Huang Research Group (2020 – PRESENT)

Graduate Research Assistant (Dr. Furong Huang)

Federated Learning (FL), Asynchronous Algorithms, Compression and Hashing, Mechanism Design, and Non-convex Optimization.

Currently as a graduate student I am...

- Constructing faster distributed algorithms via asynchronous methods
- Creating memory- and computational-efficient distributed algorithms via sketching and hashing (some which escape saddle points)
- Building mechanisms to incentivize FL participation & performance

Pacific Northwest National Laboratory (2022 – 2023)

Doctoral Internship (Dr. Nawaf Nazir)

Distributed Algorithms for Micro-grid Applications.

- Researched edge-computing algorithms with applications to inverter-based micro-grids with high renewable penetration
- Constructed a model-agnostic distributed algorithm so edge devices can collaboratively train irrespective of cost or memory constraints
- Built a decentralized FL Python package

PUBLICATIONS

M. Bornstein, T. Rabbani, E. Wang, A. Bedi, & F. Huang. "SWIFT: Rapid Decentralized Federated Learning via Wait-Free Model Communication". *International Conference on Learning Representations*, 2023.

M. Bornstein*, T. Rabbani*, & F. Huang. "Large-Scale Distributed Learning via Private On-Device LSH". *Neural Information Processing Systems*, 2023.

M. Bornstein, T. Tullius, & Y. Bayazitoglu. "Optimal nanoparticles for heat absorption and cost." *International Journal of Heat and Mass Transfer* 133 (2019): 778-785.

`Workshop Accepted:`

M. Bornstein, A. Bedi, A. Sahu, & F. Huang. "RealFM: A Realistic Mechanism to Incentivize Data Contribution and Device Participation". *NeurIPS Federated Learning Workshop*, 2023.

`Preprints:`

M. Bornstein, J. Liu, J. Li, & F. Huang. "Escaping From Saddle Points Using Asynchronous Coordinate Gradient Descent". 2022.

`Under Submission:`

T. Rabbani, B. Feng, **M. Bornstein**, & F. Huang. "Federated Learning of Large Networks on Constrained Clients via Sketching".

M. Bornstein, N. Nazir. "Model Independent Distributed Learning".

M. Bornstein*, T. Rabbani*, M. Ding, & F. Huang. "Training Extreme Recommender Systems using Compressed Virtual Labels.".

EDUCATION

2019 – PRESENT **Doctor of Philosophy Candidate**
Applied Mathematics
University of Maryland
GPA: 3.95/4.00

2019 – 2021 **Master of Science**
Applied Mathematics
University of Maryland
GPA: 3.95/4.00

2015 – 2019 **Bachelor of Science**
Mechanical Engineering
Bachelor of Arts
Comp. & Applied Mathematics
Rice University
GPA: 3.77/4.00

AWARDS

2019-2020 **Aziz-Osborn Gold Medal in Teaching Excellence**
University of Maryland

2019 **Best Energy-Related Design**
Rice University Eng. Design Showcase

2017 **NSF Travel Grant Scholarship**
University of Connecticut, 34th QPRC

2017 **Best Poster and Presentation**
Rice University, 7th Eubank Conference

SELECTED PRESENTATIONS

2022 **Oral Presentation of SWIFT: Rapid Decentralized Federated Learning via Wait-Free Model Communication**
NeurIPS Federated Learning Workshop

TEACHING EXPERIENCE

2019-PRESENT *University of Maryland*

FALL 2019 **MATH 120: Elementary Calculus I**

SPRING 2020 **MATH 140: Calculus I**

FALL 2020 **MATH 140: Calculus I**

PROGRAMMING SKILLS

ADVANCED Python, MATLAB, TensorFlow, Open MPI, OpenMP, PyTorch

INTERMEDIATE C, C++