Madhumitha Harishankar, PhD

✉ mharisha@alumni.cmu.edu | New Jersey
🌐 https://madhu.fyi/
in http://linkedin.com/in/madhumitha-harishankar/

Summary

I finished my PhD at Carnegie Mellon University this year and am currently exploring ways to contribute to Web3.

During my doctoral study, I proposed PayPlace, a Layer-2 blockchain protocol for economically scaling marketplace-style cryptocurrency (micro)payment transactions between consumers and merchants. I subsequently used this protocol to design Datanet, a practical and easily-deployable system for crypto-based authentication and payments in last-mile networks, facilitating seamless internet connectivity without locking users into long-term contracts. Also as part of my thesis on mechanisms for incentive-compatible user-driven resource allocation in wireless networks, I've worked on pricing optimizations for cellular dataplans and auction-based resource allocation methods for 5G.

Areas Blockchain, Wireless Networks, Network economics, Auction theory, Reinforcement learning, Deep learning.

Education

Jan 2016 – Jan 2021	**Ph.D., Electrical and Computer Engineering, Carnegie Mellon University, Moffett Field, CA.** **Thesis:** Incentivizing User-centric Resource Allocation in Wireless Networks in Realtime **Advisors:** Prof. Carlee Joe-Wong, Prof. Patrick Tague **Committee:** Prof. Carlee Joe-Wong, Prof. Patrick Tague, Prof. Aron Laszka, Dr. Anand Raman **Recognitions:** • **Honorable Mention** by the NSF Graduate Research Fellowship Program • **Dean's Fellow** **GPA:** 3.93 **Graduate Coursework:** Network Resource Allocation, Numerical Methods for Engineers, Security and Fairness of Deep Learning, Deep Reinforcement Learning and Control, Applied Stochastic Processes, Advanced Wireless Networks, Wireless Network Security, Mobile and Pervasive Computing **Teaching Assistant:** Introduction to Machine Learning for Engineers (18-661), Wireless Security (18-637)
Aug 2010 – May 2013	**B.S. Electrical and Computer Engineering, Rutgers University, New Brunswick, NJ.** **GPA:** 3.87 **Recognitions:** • **James Slade Scholar** • **Summa Cum Laude**

Research Publications

Preprints

1. **Harishankar, Madhumitha**, Akestoridis, D.-G., V. Iyer, S., Laszka, A., Joe-Wong, C. & Tague, P. (2020). PayPlace: Secure and Flexible Operator-Mediated Payments in Blockchain Marketplaces at Scale, arXiv 2003.06197.

2. **Harishankar, Madhumitha**, Han, J., KS, S. V., Alqarni, F., Su, S., Pan, S., Noh, H. Y., Zhang, P., Gruteser, M. & Tague, P. (2020). LaNet: Real-time Lane Identification by Learning Road Surface Characteristics from Accelerometer Data, arXiv 2004.02822.

Journal Articles

3. **Harishankar, Madhumitha**, Pikala, S., Sharma, P., Srinivasan, N., Joe-Wong, C. & Tague, P. (2019). User-driven Resource Guarantees for Interactive Multimedia Sessions via Combinatorial Auctions: An Ad Hoc Slicing Approach, In *IEEE Journal on Selected Areas in Communication (JSAC) - Special Issue on Multimedia Economics for Future Networks*. IEEE.

Conference Papers

4. Akestoridis, D.-G., **Harishankar, Madhumitha**, Weber, M. & Tague, P. (2020). Zigator: Analyzing the Security of Zigbee-Enabled Smart Homes, In ***WiSec 2020***, ACM.

5. Han, J., Chung, A., Sinha, M., **Harishankar, Madhumitha**, Pan, S., Young-Noh, H., Zhang, P. & Tague, P. (2018). Do You Feel What I Hear? Enabling Autonomous IoT Device Pairing using Different Sensor Types, In *Proceedings of IEEE Symposium on Security and Privacy 2018 (**Oakland S&P**)*, IEEE.

6. **Harishankar, Madhumitha**, Srinivasan, N., Joe-Wong, C. & Tague, P. (2018). To Accept or Not to Accept: The Question of Supplemental Discount Offers in Mobile Data Plans, In ***IEEE INFOCOM** 2018-The 37th Annual IEEE International Conference on Computer Communications*. IEEE. **Awarded Student Travel Grant.**

Workshop Papers

7. **Harishankar, Madhumitha**, Zuo, J., V. Iyer, S., Tague, P. & Joe-Wong, C. (2021). Datanet: Enabling Seamless, Metered and Trusted Network Connectivity without Subscriptions Using Blockchains, In *Proceedings of IEEE ICC 2021 Workshops*, IEEE.

8. **Harishankar, Madhumitha**, Tague, P. & Joe-Wong, C. (2018). Network Slicing as an Ad-hoc Service: Opportunities and Challenges in Enabling User-Driven Resource Management in 5G, In *Proceedings of 1st International Workshop on Trustworthy and Real-time Edge Computing for Cyber-Physical Systems (**TREC4CPS**); co-located with RTSS'19*. Institute for Software Integrated Systems, Vanderbilt University. **Awarded Student Travel Grant.**

9. Han, J., **Harishankar, Madhumitha**, Wang, X., Chung, A. J. & Tague, P. (2017b). Convoy: Physical Context Verification for Vehicle Platoon Admission, In *Proceedings of the 18th International Workshop on Mobile Computing Systems and Applications (**HotMobile**)*. ACM.

Posters and Demos

10. Han, J., **Harishankar, Madhumitha**, Wang, X., Chung, A. J. & Tague, P. (2017a). Convoy: Physical Context Verification for Vehicle Platoon Admission, In *Proceedings of the 18th International Workshop on Mobile Computing Systems and Applications (**HotMobile**)*. ACM. **Best poster runner–up award.**

Other Works

Blogs
- [Cryptoeconomics] Token Velocity is Good! And other implications of analyzing MV = PQ from first principles
- [Cryptoeconomics] Contesting Token Velocity as an Issue – Velocity-based valuation approaches may be fundamentally wrong

Talks
- "Datanet: Enabling Seamless, Metered and Trusted Last-Mile Connectivity without Subscriptions", IEEE ICC 2021 Workshop towards Standardized Secured IoT B5G networking - Artificial Intelligence and Blockchain (AB-SIoT)
- "Enabling Resource Guarantees in Wireless Networks with Auction Economics and Token Markets" at Prof. Paul Milgrom's Speaker Series, Stanford University, 2019
- "User-driven Resource Guarantees for Interactive Multimedia Sessions via Combinatorial Auctions: An Ad-hoc Slicing Approach" at Prof. Joe-Wong's lab, Carnegie Mellon University, 2019
- Presented research at Prof. Y Narahari's lab, Indian Institute of Science, Bangalore, 2019
- "Incentivizing Real-time and User-centric Resource Allocation in Wireless Networks", Thesis Proposal Talk, Carnegie Mellon University, 2018
- "To Accept or Not to Accept: The Question of Supplemental Discount Offers in Mobile Data Plans", IEEE INFOCOM 2018
- "Network Slicing as an Ad-Hoc Service: Opportunities and Challenges in Enabling User-Driven Resource Management in 5G", TREC4CPS (co-located with RTSS) 2018.

Employment History

Feb-Mar 2021
Research Assistant, LIONS Research Lab, Carnegie Mellon University
In continuation of my research work with Prof. Carlee Joe-Wong, I:
- Refined the PayPlace protocol (developed during doctoral study) for cryptocurrency payments and implemented it in Solidity. Deployed on a local Ethereum blockchain, generated a suite of test cases, and measured performance and gas costs for making payments with PayPlace.
- Prepared revised manuscript with PayPlace implementation details and performance results for publication.
- Extended our INFOCOM 2018 work on supplemental discount offers (SDO) by deploying reinforcement learning strategies to guide users' realtime SDO choices, thereby improving their data utility over the course of the month.

May-Aug 2018
Operations Research Intern, Innovation Labs, Myntra Designs Pvt. Ltd., Bangalore
As the leading e-commerce fashion company in India, Myntra ships millions of clothing pieces to customers across the country during peak sale months. During my internship, I did the following:
- Aggregated data from different parts of Myntra's order and shipping process to visualize their transport hubs, distribution centers and the end-to-end route taken by shipments from warehouses to customers.
- Defined metrics for measuring transport efficiency and generated corresponding analytics on their logistics performance during peak sale months.
- Analyzed alternate logistic models based on location-routing modeling.

Employment History (continued)

2015   **Software Development Engineer** Amazon Web Services Inc., Seattle, WA.
- Developed a knowledge-base for aiding in the resolution of support tickets created by AWS customers for various service and billing issues.
- Designed a search-optimized datamodel based on Elasticsearch, addressing concerns of network partitions, write concurrency etc. Built-in rolling deployments with regression tests to minimize outage risk during a release.
- Designed and developed AWS-compliant authentication and authorization framework for access to the knowledge-base.
- Developed a document schema that was generalizable to data from any of our sources and exposed custom search APIs exploiting this, which helped improve the latency of search queries typically executed.

2013-2014   **Software Developer** Barclays Investment Bank, New York City, NY.
- Spearheaded the Autosys Audit project. Mined data from various divisions of the firm to develop a comprehensive view of the firm's entire network infrastructure and provide automated means for its update.
- Automated Unix and Windows support operations, generating 1000+ YoY run-rate saves for the firm.
- At the Portfolio Analytics team POINT, used Hadoop and EMR to monitor the generation of analytics reports requested by customers and prune underutilized ones, saving compute resources.

Recognitions

2020   Selected as a Rising Star in EECS 2020

2019   Selected to attend the NSF-sponsored NeTS Early Career Investigators Workshop and awarded travel grant

2018   Awarded NSF-sponsored student travel grant for IEEE RTSS co-located workshop TREC4CPS 2018

        Awarded NSF-sponsored student travel grant for IEEE INFOCOM 2018

2017   Awarded Honorable Mention by the National Science Foundation Graduate Research Fellowship Program (NSF-GRFP) as a recognition of significant academic achievement

2016   Awarded full sponsorship to Computing Research Association Women's (CRA-W) 2016 Grad Cohort Workshop.

        Dean's Fellow, Carnegie Institute of Technology – 2016

2015   Winner, Microsoft International Women's Hackathon - Phoenix, Arizona.

        Nominated and sponsored by AWS Kumo to attend the Grace Hopper Celebration of Women in Computing.

2014   Nominated and sponsored by Barclays as one of five employees from the firm to attend the Grace Hopper Celebration of Women in Computing.

2013   James Slade Scholar, ECE Dept., Rutgers University. Awarded as a recognition of excellent performance in the Honors Program and successful completion of 1 year of undergraduate research.

        Summa Cum Laude, Rutgers University. Highest honors awarded by the university recognizing outstanding undergraduate performance.

        3rd Best Capstone Design Project, ECE Dept., Rutgers University.

Recognitions (continued)

2010-2013   🔖 Dean's List, ECE Dept., Rutgers University, recognizing high academic performance each semester.

🔖 Numerous merit-based undergraduate scholarships.

Service and Leadership

2021   🔖 Peer reviewer for journal IEEE Transactions on Mobile Computing (TMC)

🔖 Peer reviewer for IEEE Internet of Things journal

🔖 External reviewer for Financial Cryptography (FC)

🔖 Peer reviewer for IEEE Transactions on Network Science and Engineering

2020   🔖 Peer reviewer for IEEE Internet of Things Journal

🔖 Co-organizer and General Chair for Workshop on Blockchain for Network Resource Sharing (BlockNet), ACM Mobihoc 2020

🔖 Peer reviewer for International Conference on Communication Systems and Networks (ComNet)

🔖 Peer reviewer for journal IEEE Transactions on Mobile Computing (TMC)

🔖 External reviewer for IEEE Conference on Computer Communications (INFOCOM)

2019   🔖 Mentor for an INI Practicum project on designing decentralized wireless service providers

🔖 Peer reviewer for IEEE Journal on Selected Areas in Communication (JSAC)

🔖 External reviewer for IEEE Infocom 2020

🔖 Peer reviewer for International Conference on Communication Systems and Networks (ComNet) 2019

🔖 Peer reviewer for IEEE Sarnoff 2019

🔖 External reviewer for ACM Buildsys 2019

🔖 Peer reviewer for journal IEEE Transactions on Mobile Computing (TMC)

🔖 External reviewer for IEEE Wireless Communications and Networking Conference (WCNC)

🔖 External reviewer for IEEE Conference on Computer Communications (INFOCOM)

2018   🔖 Coordinated with the CMU Blockchain Group in Pittsburgh to have their events live-broadcasted to the Silicon Valley campus for wider participation.

2016   🔖 President, Women in ECE (WinECE), Carnegie Mellon University - Silicon Valley.

2014   🔖 Technical Manager, Women in Technology Networking program, Barclays Investment Bank.

🔖 Mentor, Streetwise Partners volunteer program to further academic and professional goals of underprivileged youth.

2013   🔖 Vice-President, IEEE-HKN Honor Society, Rutgers University, New Brunswick.

Skills

Languages	🔖 Python, Solidity, Java, c++, c#.net
Frameworks	🔖 Ethereum dApps/EVM, Elasticsearch, AWS ecosystem, Spring, ASP.Net, jQuery, Bootstrap.js, Handlebars.js
Hadoop	🔖 HDFS, Pig, Impala, Hive, AWS EMR
Databases	🔖 MySql, MSsql, Elasticsearch, DynamoDB, Linq
Tooling	🔖 Teamcity, Ant, Maven, Gradle, Sonarqube

References

Prof Carlee Joe-Wong (co-advisor)
Assistant Professor
Electrical and Computer Engineering
Carnegie Mellon University
Homepage: https://www.andrew.cmu.edu/user/cjoewong/
Email: cjoewong@andrew.cmu.edu

Prof Patrick Tague (co-advisor)
Associate Research Professor
Electrical and Computer Engineering, and Information and Networking Institute
Associate Director of Information and Networking Institute
Carnegie Mellon University
Homepage: http://mews.sv.cmu.edu/people/tague/
Phone: 650-335-2827 Email: tague@cmu.edu

Additional references available upon request.