

SHAORAN LI

Ph.D., Senior Software Engineer at NVIDIA Corporation
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EDUCATION

Ph.D., Electrical Engineering , Advisor: Dr. Tom Hou <i>Virginia Tech, Blacksburg, VA</i> Dissertation: Coping uncertainty in wireless network optimization	Aug. 2017–Oct. 2022 GPA: 4.0/4.0
M.S., Information and Communication Engineering <i>Beijing University of Posts and Telecommunications (BUPT), Beijing, China</i> Thesis: Theory and hardware research of novel shaping coded modulation based on fast-than-Nyquist signaling	Sept. 2014–Mar. 2017 GPA: 87.95/100
B.E. (Honors Program), Information Engineering <i>Southeast University, Nanjing, China</i>	Sept. 2010–June 2014 GPA: 86.54/100

WORK EXPERIENCES

NVIDIA Corporation <i>Senior Software Engineer</i>	Oct. 2022–Present
NVIDIA Corporation <i>Software Engineering Intern</i>	May 2021–Aug. 2021
Virginia Tech <i>Graduate Research Assistant</i>	Aug. 2017–Oct. 2022

HONORS AND AWARDS

Distinguished Member of INFOCOM 2024 Technical Program Committee	Feb. 2024
Fred W. Ellersick MILCOM Award for the Best Paper, Unclassified Technical Program	Nov. 2019
Prasad Scholarship	Aug. 2019
Student Travel Grant, ACM MobiHoc	July 2019
Silver Medal Award in the 1 st 5G Algorithm Innovation Competition by the InnovateAsia	
FPGA Design Contest (4/184)	Dec. 2015
Third Prize in National Postgraduate Mathematics Contest in Modeling	Nov. 2015
Top Ten Annual Individuals	Dec. 2012
Third Prize in National Undergraduate Mathematics Contest in Modeling	Oct. 2012

PUBLICATIONS

Journals Articles

- [J14] S. Li, N. Jiang, Y. Chen, W. Xie, W. Lou, and Y. T. Hou, “MU-MIMO Beamforming with Limited Channel Data Samples,” to appear in *IEEE Journal on Selected Areas in Communications*, 2024.
- [J13] N. Jai, Y. Shi, S. Li, C. Li, Y. T. Hou, W. Lou, J. H. Reed, M. Olfat, S. Kompella, and L. DaSilva, “Modeling and Optimization of Channel Allocation for PAL and GAA Users in the CBRS Band”, *IEEE Transactions on Cognitive Communications and Networking*, vol. 10, no. 1, pp. 1–20, Feb. 2024.
- [J12] Y. Chen, S. Li, C. Li, H. Zeng, B. Jalaian, Y. T. Hou, and W. Lou, “On DoF Conservation in MIMO Interference Cancellation based on Signal Strength in the Eigenspace,” *IEEE Transactions on Mobile Computing*, vol. 22, no. 5, pp. 2862–2877, May 2023.
- [J11] S. Li, Y. Huang, C. Li, Y. T. Hou, W. Lou, B. Jalaian, and S. Russell, “Achieving Real-Time Spectrum Sharing in 5G Underlay Coexistence with Channel Uncertainty,” *IEEE Transactions on Mobile Computing*, vol. 22, no. 4, pp. 1922–1937, Apr. 2023.

- [J10] **S. Li**, C. Li, Y. Huang, B. A. Jalaian, Y. T. Hou, and W. Lou, “Enhancing Resilience in Mobile Edge Computing Under Processing Uncertainty,” in *IEEE Journal on Selected Areas in Communications*, vol. 41, no. 3, pp. 659–674, Mar. 2023.
- [J9] C. Li, Q. Liu, **S. Li**, Y. Chen, Y. T. Hou, W. Lou, and S. Kompella, “Scheduling With Age of Information Guarantee,” in *IEEE/ACM Transactions on Networking*, vol. 30, no. 5, pp. 2046–2059, Oct. 2022.
- [J8] **S. Li**, Y. T. Hou, W. Lou, B. A. Jalaian, and S. Russell, “Maximizing Energy Efficiency With Channel Uncertainty Under Mutual Interference,” in *IEEE Transactions on Wireless Communications*, vol. 21, no. 10, pp. 8476–8488, Oct. 2022.
- [J7] Y. Huang, **S. Li**, Y. T. Hou, and W. Lou, “GPF+: A Novel Ultrafast GPU-Based Proportional Fair Scheduler for 5G NR,” in *IEEE/ACM Transactions on Networking*, vol. 30, no. 2, pp. 601–615, Apr. 2022.
- [J6] C. Li, Y. Huang, **S. Li**, Y. Chen, B. Jalaian, Y. T. Hou, W. Lou, J.H. Reed, and S. Kompella, “Minimizing AoI in a 5G-based IoT Network under Varying Channel Conditions,” *IEEE Internet of Things Journal*, 2021, vol. 8, no. 19, pp. 14543–14558, Oct. 2021.
- [J5] **S. Li**, Y. Huang, C. Li, B. Jalaian, Y. T. Hou, and W. Lou, “Maximize Spectrum Efficiency in Underlay Coexistence With Channel Uncertainty,” in *IEEE/ACM Transactions on Networking*, vol. 29, no. 2, pp. 764–778, Apr. 2021.
- [J4] Y. Huang, **S. Li**, Y. Chen, Y. T. Hou, W. Lou, J. Delfeld, and V. Ditya, “GPU: A New Enabling Platform for Real-Time Optimization in Wireless Networks,” *IEEE Network*, vol. 34, no. 6, pp. 77–83, Nov. 2020.
- [J3] C. Li, **S. Li**, Y. Chen, Y. T. Hou, and W. Lou, “Minimizing Age of Information under General Models for IoT Data Collection,” *IEEE Transactions on Network Science and Engineering*, vol. 7, no. 4, pp. 2256–2270, Oct. 2020.
- [J2] Y. Huang, **S. Li**, C. Li, Y. T. Hou, and W. Lou, “A Deep Reinforcement Learning-based Approach to Dynamic eMBB/URLLC Multiplexing in 5G NR,” *IEEE Internet of Things Journal*, vol. 7, no. 7, pp. 6439–6456, July 2020.
- [J1] Z. Wu, Hui Che, and **S. Li**, “Spectral efficiency and parameter optimization analysis for faster-than-Nyquist signaling,” *System Engineering and Electronics*, vol. 38, pp. 1153–1158, May 2016.

Peer-reviewed Conference Publications

- [C16] **S. Li**, N. Jiang, C. Li, Y. T. Hou, W. Lou, and W. Xie, “ReDBeam: Real-time MU-MIMO Beamforming with Limited CSI Data Samples,” to appear in *Proc. IEEE ICC*, June 2024.
- [C15] S. Acharya, **S. Li**, N. Jiang, Y. Wu, Y. T. Hou, W. Lou, and W. Xie, “Mitra: An O-RAN based Real-Time Solution for Coexistence between General and Priority Users in CBRS,” *Proc. IEEE MASS*, pp. 295–303, Toronto, Canada, Sept. 2023.
- [C14] C. Li, **S. Li**, Q. Liu, Y. T. Hou, W. Lou and S. Kompella, “Eywa: A General Approach for Scheduler Design in AoI Optimization,” in *Proc. IEEE INFOCOM*, pp. 1–9, Virtual Conference, May 2023.
- [C13] **S. Li**, N. Jiang, Y. Chen, Y. T. Hou, W. Lou, and W. Xie, “D²BF—Data-Driven Beamforming in MU-MIMO with Channel Uncertainty,” in *Proc. IEEE INFOCOM*, pp. 120–129, Virtual Conference, May 2022.
- [C12] N. Jai, **S. Li**, C. Li, Y. T. Hou, and W. Lou, “Optimal Channel Allocation in the CBRS Band with Shipborne Radar Incumbents,” in *Proc. IEEE DySBAN*, pp. 80–88, Virtual Conference, Dec. 2021 **Best Paper Award Runner-up**.
- [C11] **S. Li**, C. Li, Y. Huang, Y. T. Hou, and W. Lou, “On Task Offloading with Uncertain Processing Cycles in Mobile Edge Computing,” in *Proc. ACM MobiHoc*, pp. 51–60, Shanghai, China (Hybrid Mode), July 2021.
- [C10] C. Li, Q. Liu, **S. Li**, Y. Chen, Y. T. Hou, and W. Lou, “On Scheduling with AoI Violation

- Tolerance,” in *Proc. IEEE INFOCOM*, pp. 1–9, Virtual Conference, May 2021
- [C9] C. Li, **S. Li**, Y. Chen, Y. T. Hou, and W. Lou, “AoI Scheduling with Maximum Thresholds,” in *Proc. IEEE INFOCOM*, pp. 436–445, Virtual Conference, May 2020
- [C8] **S. Li**, Y. Huang, C. Li, B. Jalaian, S. Russell, Y. T. Hou, W. Lou, and B. MacCall, “A Real-Time Solution for Underlay Coexistence with Channel Uncertainty,” in *Proc. IEEE GLOBECOM*, pp. 1–6, Waikoloa, HI, Dec. 2019
- [C7] **S. Li**, Y. T. Hou, W. Lou, B. Jalaian, S. Russell, and B. MacCall, “Optimal Power Control with Channel Uncertainty in Ad Hoc Networks,” in *Proc. IEEE/AFCEA MILCOM*, pp. 652–657, Norfolk, VA, Nov 2019 **Best Paper Award in Unclassified Technical Program**
- [C6] **S. Li**, Y. Huang, C. Li, B. Jalaian, Y. T. Hou, and W. Lou, “Coping Uncertainty in Coexistence via Exploitation of Interference Threshold Violation,” in *Proc. ACM MobiHoc*, pp. 71–80, Catania, Italy, July 2019
- [C5] C. Li, **S. Li**, and Y. T. Hou, “A General Model for Minimizing Age of Information at Network Edge,” in *Proc. IEEE INFOCOM*, pp. 118–126, Paris, France, Apr. 2019
- [C4] Y. Chen, **S. Li**, C. Li, Y. T. Hou, and B. Jalaian, “To Cancel or Not to Cancel: Exploiting Interference Signal Strength in the Eigenspace for Efficient MIMO DoF Utilization,” in *Proc. IEEE INFOCOM*, pp. 1954–1962, Paris, France, Apr. 2019
- [C3] Y. Huang, **S. Li**, Y. T. Hou, and W. Lou, “GPF: A GPU-based Design to Achieve $\sim 100 \mu s$ Scheduling for 5G NR,” in *Proc. ACM MobiCom*, pp. 207–222, New Delhi, India, Oct. 2018
- [C2] **S. Li**, Z. Wu, and H. Che, “Faster-than-Nyquist System Based on Novel Shaping Waveforms,” in *Proc. IEEE IMCCC*, pp. 461–464, Harbin, China, July 2016
- [C1] T. Ren, Z. Wu, H. Che, and **S. Li**, “A Self-adaptive Algorithm of Carrier Frequency Offset Estimate in Wireless Network,” *Proc. IEEE International Computer Conference on Wavelet Active Media Technology and Information Processing (ICCWAMTIP)*, Chengdu, China, Dec. 2015

TEACHING EXPERIENCES

Teaching Assistant

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| [T1] Signals and Systems, Virginia Tech | Aug. 2017–May 2018 |
| [T2] Principles of Communications, BUPT | Sept. 2014–June. 2015 |

Invited Seminar

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| [S1] Coping uncertainty in coexistence via exploitation of interference threshold violation, Wireless@VT Seminar | Nov. 2019 |
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RESEARCH EXPERIENCES

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| [P6] NVIDIA Aerial: GPU-accelerated 5G vRAN | Oct. 2022–Present |
| <ul style="list-style-type: none"> • “Acceleration”: Provide 3GPP compliant and efficient 5G solutions with GPU parallel computing • Implement GPU-accelerated 5G wireless system with 3GPP compliance and explore new features beyond 5G • Design new software algorithms for wireless network functions • More info about NVIDIA Aerial SDK: https://developer.nvidia.com/aerial-sdk | |
| [P5] Wireless networking in presence of uncertainty | May 2018–Present |
| <ul style="list-style-type: none"> • “Uncertainty”: Optimize network performance when some network parameters are only known by statistics or limited data samples (e.g., channel uncertainty, task processing uncertainty) • Modeling of network optimization under uncertainty by exploring occasional threshold violation • Apply chance-constrained programming (CCP) to reformulate statistical formulation into deterministic one, and derive solutions with probabilistic guarantees (e.g., data rates, task deadlines) | |

- [P4] **Real-time optimization in wireless networking on GPU platforms** May 2018–Present
- *Challenge: “Real-time”—Derive scheduling solution within $\sim 100 \mu s$ due to TTI length in 5G*
 - Decompose the original optimization problem into massive subproblems, select a subset of promising subproblems, solve the subproblems in parallel, obtain the best feasible solution
 - Optimize GPU implementation regarding threads and memory management to meet real-time
- [P3] **Deep Learning in PUCCH signal detection** May 2021–Aug. 2021
- *“Detection”: Detect PUCCH discontinuous transmission (DTX) using deep learning*
 - Algorithm tests and performance analysis in simulated 5G scenarios
- [P2] **Optimizing information freshness in wireless networks** May 2018–Oct. 2022
- *“Freshness”: Employ Age of Information (AoI) in networking, a new and powerful metric*
 - Modeling of network optimization problems under uncertainty (e.g., channel uncertainty, processing uncertainty)
 - Apply chance-constrained programming (CCP) and reformulate statistic formulation into deterministic ones
 - Derive solutions with probabilistic performance guarantees (e.g., data rates, task deadlines)
- [P1] **Link-level transceiver implementation on FPGA platforms** Sept. 2014–Mar. 2017
- *“FPGA”: Implement transceiver on Intel and Xilinx FPGAs*
 - Design baseband signal processing modules using Verilog HDL
 - Related topics: Sparse code multiple access (SCMA), faster-than-Nyquist (FTN), OFDM

PROFESSIONAL SERVICES

Technical Program Committee Member of ICC 2024	Nov. 2023
Technical Program Committee Member of INFOCOM 2024	Aug. 2023
Technical Program Committee Member of IEEE ICCCN 2023	Mar. 2023
Member of IEEE and IEEE ComSoc	Aug. 2017–Present
Reviewer of IEEE/ACM Transactions on Networking, IEEE Transactions on Vehicular Technology, IEEE Journal on Selected Areas in Communications, IEEE Wireless Communications, IEEE Communications Letters, IEEE INFOCOM, IEEE ICC, IEEE ICCCN	2018–Present

TECHNICAL STRENGTHS

Language	C/C++, CUDA, MATLAB, Python, Verilog HDL, and L ^A T _E X
Software	Visual Studio, Git, Matlab, Modelsim, Quartus, and Vivado
Skills	Professional knowledge in wireless communication and network research Hands-on experience of hardware implementation, especially on GPU and FPGA

REFERENCES

Dr. Tom Hou, *Bradley Distinguished Professor of ECE, Virginia Tech*, thou@vt.edu
 Dr. Wenjing Lou, *W. C. English Endowed Professor of CS, Virginia Tech*, wjlou@vt.edu
 Dr. Jeff Reed, *Willis G. Worcester Professor of ECE, Virginia Tech*, reedjh@vt.edu
 Dr. Christian Ibars, *Senior Engineering Manager, NVIDIA Corporation*, cibars@nvidia.com