

RESEARCH INTERESTS

My research interests lies in the area of scalable, decentralized, and robust array signal processing algorithms for wireless and sensing applications, with emphasis on reducing algorithmic complexities of covariance estimation, adaptive beamforming, etc. I leverage tools like convex/nonconvex optimization, sparse regression, and rank-reduction techniques to solve challenges in systems with massive arrays such as extremely large MIMO and decentralized cell-free networks.

EDUCATION

Ph.D. Candidate, M.S. in Electrical and Computer Engineering
GPA: 3.85/4, University of California-Los Angeles, Los Angeles, CA Sep. 2020 - present
Signal & System Track, Advisor: Prof. Danijela Cabric
Research Areas: Digital Communication, Signal Processing, Compressed Sensing, Large-scale Optimization
Thesis: Robust, scalable, and distributed algorithms for array signal processing

Bachelor of Science, Applied Mathematics, Physics & Engineering
GPA: 3.91/4, University of Wisconsin-Madison, Madison, WI Sep. 2018 - Jun. 2020
Courses: Digital Communication, Image Processing, Computer Networking, Applied Stochastic Processes

RESEARCH EXPERIENCE

- **Graduate Student Researcher: Cognitive and Reconfigurable Embedded System Lab, UCLA**
 - **Scalable On-Array Processing (SOAP):** Fall 2024 - Now
 - * Collaboration with HPC team from Intel Corp. and Northrop Grumman Corp.
 - Develop **decentralized, low-complexity, and stable** Krylov subspace method that works under **single precision**
 - Minimize number of **matrix-vector multiplication** and **avoid matrix inversion** to reduce processing bottlenecks
 - Implement kernelized algorithms for validating **a linear growth of flops w.r.t problem size**
 - **Silicon-Photonic Link Modeling in mmWave Bands:** Fall 2023
 - * Collaboration with Boston University and Berkeley Wireless Research Center
 - Model micro-ring resonators based on coupled modes theory in Simulink
 - Analyze system nonlinearities from analog optical components and its impact on link-level simulation
 - **Fast Solvers for Continuous Compressed Sensing and Non-linear Inverse Problems:** Spring 2023
 - Develop a **low-complexity solver for super-resolution parameter estimation**
 - Apply the solver to versatile sparse regressions with multi-dimensional continuous basis
 - Integrate fast Fourier transform into the solver for **drastic reduction on execution time**
 - **Low-complexity Adaptive Beamforming with GPU-Accelerated Tensor Libraries:** Summer 2021 - Fall 2022
 - * Collaboration with teams from Nvidia Corp. and Raytheon Technologies Corp.
 - Develop and implement a convolutional neural network that performs image super-resolution
 - Implement conjugate gradient method for adaptive beamforming
 - Accelerate computations using NVIDIA CuPy library
 - **Frequency Domain Multiple Access with mmWave TTD Array:** Spring 2021 - Fall 2021
 - Design grant-free contention-based multiple access protocol for mmWave true-time-delay network
 - Evaluate system performance through simulations in terms of latency, rates, and user density with a focus on **achieving sub-millisecond access delay with ultra-high reliability**.
 - **mmRapid Extension for Non-Line-of-Sight Channels:** Fall 2020 - Fall 2021
 - Develop method for codebook optimization in neural-network-assisted mmWave initial access algorithm (mmRapid)
 - Verify trade-offs between robustness and spatial resolution in codebook design
- **Undergraduate Research: Applied Mathematics, Physics & Engineering, UW-Madison**
 - **Symmetry of Generalized Lyapunov Exponent:** Summer 2019 - Summer 2020
 - Research oriented project related to products of random matrices, ergodic theory, Lie algebra
 - Investigate the symmetry of generalized Lyapunov exponent with negative momentum.
 - **Bleed-through Removal:** Fall 2019
 - Research oriented project related to belief propagation, principle component analysis
 - Implement image processing algorithms for identification and removal of bleed-through in historical documents

INDUSTRIAL EXPERIENCE

- **Qualcomm Technology Inc.:** Interim Engineering Intern Summer 2024
 - Team: RF Platform and Interfaces; Supervisor: Dr. Intae Kang, Mentor: Dr. Ni-Chun Wang;
 - Provide weekly research updates on nonlinear system modeling and identification for PA nonlinearity
 - Deliverable: an analyzer that selects nonlinear basis through regularized regression for modeling/compensating nonlinearity

SKILLS SUMMARY

- **Programming Languages:** (in descending order of proficiency) MATLAB, Python, C/C++, Mathematica

LIST OF SELECTED PUBLICATIONS

- **Publications (Journal):**
 - **R. Li** and D. Cabric, "A Coordinate Descent Approach to Atomic Norm Denoising," in *IEEE Transactions on Signal Processing*, vol. 72, pp. 5077-5090, 2024, doi: 10.1109/TSP.2024.3486533.
 - **R. Li**, H. Yan and D. Cabric, "Rainbow-Link: Beam-Alignment-Free and Grant-Free mmW Multiple Access Using True-Time-Delay Array," in *IEEE Journal on Selected Areas in Communications*, vol. 40, no. 5, pp. 1692-1705, May 2022, doi: 10.1109/JSAC.2022.3143261.
 - E. Krijestorac, **R. Li**, D. Cabric, J. McGraw, P. Powers, J. Vitaz, M. Salpukas, D. Eustice, and T. Allen, "Machine Learning-Assisted Computationally Efficient Target Detection and Tracking in Massive Fully Digital Phased Arrays," in *IEEE Transactions on Radar Systems*, vol. 1, pp. 353-367, 2023, doi: 10.1109/TRS.2023.3298340.
- **Publications (Conference Proceedings):**
 - **R. Li** and D. Cabric, "Decentralized Sparse Regression for Super-Resolution DoA Estimation," IEEE ICC, Montreal, QC, Canada, 2025, pp. 5512-5517, doi: 10.1109/ICC52391.2025.11161548.
 - **R. Li** and D. Cabric, "Covariance Denoising with Applications to Adaptive Beamforming," 2024 IEEE International Symposium on Phased Array Systems and Technology (PAST), Boston, MA, USA, 2024, pp. 1-8, doi: 10.1109/ARRAY58370.2024.10880401.
 - **R. Li** and D. Cabric, "Robust Adaptive Beamforming with Proximal Method," 2023 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Rhodes Island, Greece, 2023, pp. 1-5, doi: 10.1109/ICASSP49357.2023.10095114.
 - **R. Li**, S. Sarkar, D. Cabric, J. McGraw, P. Powers and J. Vitaz, "Fast ML-Assisted Interference Estimation and Suppression for Digital Phased Array Radar," 2022 IEEE International Symposium on Phased Array Systems & Technology (PAST), Waltham, MA, USA, 2022, pp. 1-8, a: 10.1109/PAST49659.2022.9974996.
 - B. W. Domae, V. Boljanovic, **R. Li** and D. Cabric, "Machine Learning Prediction for Phase-less Millimeter-Wave Beam Tracking," 2022 IEEE 23rd International Workshop on Signal Processing Advances in Wireless Communication (SPAWC), Oulu, Finland, 2022, pp. 1-5, doi: 10.1109/SPAWC51304.2022.9833935.
 - B. W. Domae, **R. Li** and D. Cabric, "Machine Learning Assisted Phase-less Millimeter-Wave Beam Alignment in Multipath Channels," 2021 IEEE Global Communications Conference (GLOBECOM), Madrid, Spain, 2021, pp. 1-7, doi: 10.1109/GLOBECOM46510.2021.9685678.

TEACHING EXPERIENCE

- **Teaching Associate, UCLA:**
 - EE230A-LEC-80, Detection and Estimation in Communication Spring 2022
 - ECE233, Wireless Commun. System Design, Modeling, and Implementation Spring 2023
 - ECE205, Matrix Analysis Fall 2023

REFERENCES

- **Dr. Danijela Cabric:**
 - Professor at UCLA ECE, IEEE Fellow
 - Email: danijela@ee.ucla.edu