Majid Moradikia

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Research Interests

Edge intelligence for wireless and physical systems. RF/microwave sensing and computational imaging; edge/cloud Wi-Fi health monitoring and channel/band recommendation; trustworthy AI for edge and mobile computing.

Research agenda: Physical and agentic AI at the edge—connecting sensing, interpretation, learning, and feedback-driven action through resource-aware inference, on-device learning, and hardware/software co-design.

Education

Ph.D., Electrical Engineering (Communication Systems) September 2019

Shiraz University of Technology, Shiraz, Iran.

Dissertation: *SAR Imaging Based on Undersampled Data with Low-Rank Plus Sparse Decomposition (LRSD).*

M.Sc., Electrical Engineering (Communication Systems) September 2013

Islamic Azad University, Science and Research Branch, Tehran, Iran.

B.Sc., Electrical Engineering (Electronics) November 2009

Islamic Azad University, Birjand Branch, Birjand, Iran.

Academic Appointments

Worcester Polytechnic Institute Worcester, MA

Research Scientist Oct. 2023–Aug. 2024

Postdoctoral Research Fellow Aug. 2022–Oct. 2023

University of Houston Houston, TX

Postdoctoral Research Fellow Apr. 2021–Aug. 2022

Sharif University of Technology Tehran, Iran

Researcher Jun. 2019–Nov. 2020

Industry Appointment

Comcast Philadelphia, PA

Senior Wireless Engineer Apr. 2024–Present

Reliability & Analytics Data Science (RADS) Team

Honors and Awards

IEEE ORSS Best Paper Award (coauthor); paper [C4]. 2023

First Place, Constrained Category, AFRL Beyond 5G SDR University Challenge (team award). 2022

Outstanding Ph.D. Student, Shiraz University of Technology. 2019

Selected Research Contributions

Edge/cloud intelligence for Wi-Fi *(Comcast)*

Co-developed an **edge/cloud model for Wi-Fi health monitoring and optimal channel/band recommendation**. Develop statistical and machine-learning methods connecting gateway/client telemetry to wireless link health and application-quality risk. Establish feature, label, and validation frameworks for WebRTC audio/video and set-top-box quality assessment, supported by controlled network stress tests and packet-level validation.

RF/microwave sensing and physical-state interpretation *(WPI)*

Led signal-processing and ML work within the USDA-funded SoilX project for root-zone soil-moisture estimation from ground-penetrating radar (GPR). Helped develop radar hardware–software and data-acquisition pipelines, coordinated measurement campaigns and cross-institution collaboration, and mentored researchers on waveform design, signal emulation, feature extraction, and inversion. [J21], [J18], [C6], [C4].

Robust and hardware-aware wireless learning *(UH and collaborations)*

Developed GAN-based defenses for neural radio classifiers and evaluated them over the air on USRP software-defined radios in the AFRL challenge. Coauthored research on adversarial attacks against graph-based resource management, active-learning hybrid precoding, and secure communication under hardware impairments. [C3], [J19], [J16], [J10].

Data-efficient computational RF imaging *(doctoral research and collaborations)*

Developed optimization-based methods for SAR imaging and scene decomposition from undersampled measurements, using low-rank and sparse priors to recover scene structure and separate moving targets from background. Coauthored extensions in fast SAR/ISAR reconstruction and real-time sparsity-driven imaging. [J6], [J11], [J14], [J9].

Publications

Peer-Reviewed Journal Articles

[J21] V. Filardi, N. Khosravi Largani, S. Zekavat, **M. Moradikia**, B. Wilson, R. Askari, O. Mangoubi, "Toward Intelligent GPR: Wavelet Scattering Networks for Soil Water Content Prediction," *IEEE Transactions on AgriFood Electronics*, 2026.

[J20] H. R. Hashempour, H. Bastami, **M. Moradikia**, S. A. Zekavat, H. Behroozi, G. Berardinelli, A. L. Swindlehurst, "Secure SWIPT in the Multiuser STAR-RIS Aided MISO Rate-Splitting Downlink," *IEEE Transactions on Vehicular Technology*, vol. 73, no. 9, pp. 13466–13481, 2024.

[J19] A. Ghasemi, E. Zeraatkar, **M. Moradikia**, S. A. Zekavat, "Adversarial Attacks on Graph Neural Networks Based Spatial Resource Management in P2P Wireless Communications," *IEEE Transactions on Vehicular Technology*, vol. 73, no. 6, pp. 8847–8863, 2024.

[J18] H. Namdari, **M. Moradikia**, S. Zekavat, R. Askari, O. Mangoubi, D. Petkie, "Advancing Precision Agriculture: Machine Learning-Enhanced GPR Analysis for Root-Zone Soil Moisture Assessment in Mega Farms," *IEEE Transactions on AgriFood Electronics*, 2024, doi: 10.1109/TAFE.2024.3455238.

[J17] H. Bastami, H. Behroozi, **M. Moradikia**, A. Abdelhadi, D. W. K. Ng, L. Hanzo, "Large-Scale Rate-Splitting Multiple Access in Uplink UAV Networks: Effective Secrecy Throughput Maximization Under Limited Feedback Channel," *IEEE Transactions on Vehicular Technology*, vol. 72, no. 7, pp. 9267–9280, 2023.

[J16] M. Nouri, H. Behroozi, H. Bastami, **M. Moradikia**, A. Jafarieh, A. Abdelhadi, Z. Han, "Hybrid Precoding Based on Active Learning for mmWave Massive MIMO Communication Systems," *IEEE Transactions on Communications*, vol. 71, no. 5, pp. 3043–3058, 2023.

[J15] H. Bastami, **M. Moradikia**, A. Abdelhadi, H. Behroozi, B. Clerckx, L. Hanzo, "Maximizing the Secrecy Energy Efficiency of the Cooperative RS-Aided Downlink in Multi-Carrier UAV Networks," *IEEE Transactions on Vehicular Technology*, vol. 71, no. 11, pp. 11803–11819, 2022.

[J14] H. R. Hashempour, **M. Moradikia**, H. Bastami, A. Abdelhadi, M. Soltanalian, "Fast and Robust LRSD-Based SAR/ISAR Imaging and Decomposition," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 60, pp. 1–13, 2022.

[J13] A. Hassanpour, **M. Moradikia**, B. Yang, A. Abdelhadi, C. Busch, J. Fierrez, "Differential Privacy Preservation in Robust Continual Learning," *IEEE Access*, vol. 10, pp. 24273–24287, 2022.

[J12] H. Bastami, M. Letafati, **M. Moradikia**, A. Abdelhadi, H. Behroozi, L. Hanzo, "On the Physical Layer Security of the Cooperative Rate-Splitting-Aided Downlink in UAV Networks," *IEEE Transactions on Information Forensics and Security*, vol. 16, pp. 5018–5033, 2021.

[J11] **M. Moradikia**, S. Samadi, H. R. Hashempour, M. Çetin, "Video-SAR Imaging of Dynamic Scenes Using Low-Rank and Sparse Decomposition," *IEEE Transactions on Computational Imaging*, vol. 7, pp. 384–398, 2021.

[J10] H. Bastami, **M. Moradikia**, H. Behroozi, R. C. de Lamare, A. Abdelhadi, Z. Ding, "Secrecy Rate Maximization for Hardware-Impaired Untrusted Relaying Network with Deep Learning," *Physical Communication*, vol. 49, 101476, 2021.

[J9] A. Asadipooya, S. Samadi, **M. Moradikia**, R. Mohseni, "Majorization–Minimization Approach for Real-Time Enhancement of Sparsity-Driven SAR Imaging," *Journal of Real-Time Image Processing*, vol. 18, no. 5, pp. 1441–1455, 2021.

[J8] S. Mashdour, **M. Moradikia**, P. L. Yeoh, "Secure mm-Wave Communications with Imperfect Hardware and Uncertain Eavesdropper Location," *Transactions on Emerging Telecommunications Technologies*, vol. 31, no. 10, e4016, 2020.

[J7] **M. Moradikia**, H. Bastami, A. Kuhestani, H. Behroozi, L. Hanzo, "Cooperative Secure Transmission Relying on Optimal Power Allocation in the Presence of Untrusted Relays, a Passive Eavesdropper and Hardware Impairments," *IEEE Access*, vol. 7, pp. 116942–116964, 2019.

[J6] **M. Moradikia**, S. Samadi, M. Çetin, "Joint SAR Imaging and Multi-Feature Decomposition From 2-D Under-Sampled Data via Low-Rankness Plus Sparsity Priors," *IEEE Transactions on Computational Imaging*, vol. 5, no. 1, pp. 1–16, 2019.

[J5] A. Hassanpour, **M. Moradikia**, H. Adeli, S. R. Khayami, P. Shamsinejadbabaki, "A Novel End-to-End Deep Learning Scheme for Classifying Multi-Class Motor Imagery EEG Signals," *Expert Systems*, 2019.

[J4] A. Kuhestani, A. Mohammadi, K.-K. Wong, P. L. Yeoh, **M. Moradikia**, M. R. A. Khandaker, "Optimal Power Allocation by Imperfect Hardware Analysis in Untrusted Relaying Networks," *IEEE Transactions on Wireless Communications*, vol. 17, no. 7, pp. 4302–4314, 2018.

[J3] **M. Moradikia**, S. Mashdour, A. Jamshidi, "Joint Optimal Power Allocation, Cooperative Beamforming, and Jammer Selection Design to Secure Untrusted Relaying Network," *Transactions on Emerging Telecommunications Technologies*, vol. 29, no. 3, e3276, 2018.

[J2] H. Zarrabi, A. Kuhestani, **M. Moradikia**, "EE-RS and PA for Untrusted Relay Network at High Signal-to-Noise Ratio Regime," *IET Communications*, vol. 10, no. 16, pp. 2143–2148, 2016.

[J1] M. A. Pourmina, **M. Moradikia**, "Stackelberg Game on Space and Frequency Heterogeneity Analysis in an OFDMA-Based Cognitive Spectrum Leasing," *Wireless Personal Communications*, vol. 84, pp. 341–359, 2015.

Peer-Reviewed Conference and Workshop Papers

[C8] A. Ghasemi, **M. Moradikia**, S. R. Zekavat, H. Pishro-Nik, "Adversarial Attacks Targeting Point-to-Point Wireless Networks," in *Proc. IEEE VTC-Spring*, pp. 1–6, 2024.

[C7] S. Salehi, S. Mashdour, O. Tamyigit, S. Seyedmasoumian, **M. Moradikia**, R. C. de Lamare, A. Schmeink, "Learning-Based AP Selection in User-Centric Cell-Free Massive MIMO Networks," in *Proc. European Wireless 2024: 29th European Wireless Conference*, pp. 53–58, 2024.

[C6] H. Namdari, **M. Moradikia**, D. T. Petkie, R. Askari, S. Zekavat, "Comprehensive GPR Signal Analysis via Descriptive Statistics and Machine Learning," in *Proc. IEEE WiSEE*, 2023.

[C5] A. Ghasemi, E. Zeraatkar, **M. Moradikia**, S. A. Zekavat, "Adversarial Attacks on Resource Management in P2P Wireless Communications," in *Proc. IEEE WiSEE*, 2023.

[C4] V. Filardi, A. Cheung, R. Khan, O. Mangoubi, **M. Moradikia**, S. R. Zekavat, B. Wilson, R. Askari, D. Petkie, "Data-Driven Soil Water Content Estimation at Multiple Depths Using SFCW GPR," in *Proc. IEEE ORSS*, pp. 86–90, 2023. *Best Paper Award.*

[C3] E. Shtaiwi, A. E. Ouadrhiri, **M. Moradikia**, S. Sultana, A. Abdelhadi, Z. Han, "Mixture GAN for Modulation Classification Resiliency Against Adversarial Attacks," in *Proc. IEEE GLOBECOM*, pp. 1472–1477, 2022.

[C2] H. Bastami, **M. Moradikia**, M. Letafati, A. Abdelhadi, H. Behroozi, "Outage-Constrained Robust and Secure Design for Downlink Rate-Splitting UAV Networks," in *Proc. IEEE ICC Workshops*, pp. 1–7, 2021.

[C1] **M. Moradikia**, S. Samadi, "SAR Image Formation and Feature Separation via Low-Rank Sparse Decomposition," in *Proc. Iranian Conference on Electrical Engineering (ICEE)*, pp. 737–742, 2018.

Conference Abstracts and Posters

[A3] B. Heusdens, S. Chatterjee, S. A. R. Zekavat, R. Askari, **M. Moradikia**, "Machine Learning-Based Ground Penetrating Radar Inversion and Mapping of Crop-Scale Soil Moisture," *AGU Fall Meeting*, San Francisco, CA, 2023. Poster.

[A2] S. Zekavat, **M. Moradikia**, "GPR System Design for Intelligent Root-Zone Soil Moisture Characterization and Optimal Farm Irrigation," *78th Soil and Water Conservation Society International Annual Conference*, Des Moines, IA, 2023. Poster.

[A1] S. Zekavat, **M. Moradikia**, R. Askari, "Enhanced Soil Moisture Estimation via Intelligent Full Waveform Inversion of GPR Data," *78th Soil and Water Conservation Society International Annual Conference*, Des Moines, IA, 2023. Poster.

Sponsored Research

Funded Research Participation

SoilX: Intelligent RF-Based Soil Moisture Imaging for Optimal Irrigation. USDA-funded collaborative project at Worcester Polytechnic Institute. Research Scientist and Postdoctoral Research Fellow; contributions in ML-enabled GPR, experimental coordination, and student research mentoring during 2022–2024.

Teaching Experience and Interests

Lecturer Jan. 2016–Dec. 2019

Shahid Bahonar Technical & Engineering College, Shiraz, Iran

Electrical Circuits I & II; Signals & Systems; Communication Systems; Electronics Lab.

Teaching Assistant Jan. 2017–Jan. 2019

Shiraz University of Technology, Shiraz, Iran

Digital Communications; Stochastic Processes.

Across these teaching roles, prepared lecture notes and problem sets, held office hours, and helped develop laboratory exercises connecting theory to practice.

Teaching Interests

Foundational ECE: Signals & Systems; Digital Signal Processing; Probability and Random Processes; Digital Communications; Electrical Circuits.

Advanced and project-based: Machine Learning for Wireless and Sensing Systems; Statistical Signal Processing; Wireless Networks; Optimization for Communications; Wireless/SDR Laboratory; Edge AI for RF Sensing and Wireless Systems.

Research Mentoring and Student Projects

Mentored **8 graduate and 6 undergraduate researchers**, supporting project scoping, experimental design, code review, technical writing, and conference preparation. Degree levels below refer to the mentoring period.

Graduate Research Mentoring

- **Ahmad Ghasemi** (Ph.D., WPI): intelligent radio-resource allocation for 5G/6G wireless systems.
- **Saeed H. Jahromi** (Ph.D., WPI): drone-based FMCW GPR development using FPGA platforms.
- **Noushin Khosravi Largani** (Ph.D., WPI): deep-reinforcement-learning-based adaptive OFDM waveform design for GPR.
- **Himan Namdari** (Ph.D., WPI): intelligent GPR signal emulation using gprMax.
- **Vincent Filardi** (Ph.D., WPI): GPR signal feature extraction.
- **Breeanne Heusdens** (Ph.D., Michigan Technological University): GAN-assisted full-waveform inversion for soil-moisture characterization.
- **Salma Sultana** (M.Sc., UH): GAN-based defenses for neural modulation classification.
- **Eyad Shtaiwi** (Ph.D., UH): reconfigurable-intelligent-surface-based wireless communications for 5G and beyond.

Undergraduate Research Projects at WPI

- **Ravi Palmieri**: reverse engineering of off-the-shelf SFCW radar software.
- **Allen Cheung**: rail-based GPR data acquisition.
- **Ruba Khan**: statistical analysis of GPR measurements.
- **Joshua Thurber, Ethan Reed, and Nicholas Latsis**: radar assembly, drone-based experimental setup, and field measurements.

Invited Talks and Conference Talks

Soil Subsurface Characterization via Radar Technology. Invited talk and research visit, Michigan Technological University. 2023

An Introduction to Digital Twins for Meta-Surface-Empowered Wireless Networks. Conference talk, IEEE DTPI, Boston, MA. 2022

Professional Service

Journal reviewing: IEEE Systems Journal; IEEE Transactions on Computational Imaging; IEEE Transactions on Geoscience and Remote Sensing; IEEE Geoscience and Remote Sensing Letters; IEEE Transactions on Vehicular Technology; IEEE Access; *Signal Processing* (Elsevier); *Wireless Personal Communications* (Springer).

University service: Judge, Worcester Polytechnic Institute Graduate Research Innovation Exchange (GRIE).