# Research Statement

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## Research Summary

My research lies at the intersection of wireless sensing, trustworthy AI, generative AI, Internet of Things (IoT), smart health, wireless localization, wireless networks, and IoT security. My research agenda is driven by the vision of building intelligent, robust, interpretable, secure, and scalable wireless systems for next-generation IoT applications, including smart health, localization, wireless sensing, spectrum intelligence, and cybersecurity.

Since joining FIU, my work has resulted in more than 60 publications in leading conferences and journals, including IEEE INFOCOM, ACM SenSys, ACM MobiCom, IEEE/CVF CVPR, Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT), IEEE Transactions on Mobile Computing, and IEEE/ACM Transactions on Networking. My scholarship has been recognized through the NSF CRII Award and several major research honors, including the IEEE ICNC 2026 Best Paper Award, the ACM FAcct 2023 Best Paper Award, the 2022 Best Journal Paper Award of IEEE ComSoc eHealth Technical Committee. I was also selected for Stanford University's World's Top 2% Scientists list from 2022 to 2025. As a junior faculty member, my work has received 8,514 citations with an h-index of 38 according to Google Scholar. I have also established a strong externally funded research program as Principal Investigator, currently leading five NSF-supported projects totaling approximately $4.4 million, including about $1.31 million as my share of PI funding. More importantly, my NSF CAREER project has been recommended for funding.

My research contributions can be organized into three major directions: robust wireless localization and channel prediction systems, smart health monitoring systems, and wireless IoT device security.

**Robust Wireless Localization and Channel Prediction Systems.** High-resolution localization and AI-enabled channel prediction are expected to be key capabilities for future 6G systems. To address challenging non-line-of-sight (NLOS) indoor environments, we have developed AI/ML-based fingerprinting localization methods using Wi-Fi channel state information (CSI). My previous work, DeepFi, was the first deep-learning-based Wi-Fi CSI indoor localization system and received the IEEE Vehicular Technology Society 2020 Jack Neubauer Memorial Award. To further improve localization performance, we developed new CSI representations, including CSI images and CSI tensors, and designed robust and explainable localization methods such as deep Gaussian processes and AdvLoc, an adversarial training framework that improves localization robustness against perturbations. Beyond Wi-Fi localization, we have developed robust 5G localization systems using deep convolutional Gaussian processes with mmWave beamforming features, large-scale cellular localization for pickup position recommendation in practical 5G environments, and neural ordinary differential equations (ODEs)-based methods for defending massive MIMO localization against adversarial attacks. More recently, we have expanded this research direction to efficient and explainable wireless channel prediction, including Kolmogorov-Arnold networks (KANs)-based wireless radiation field prediction, which appeared in IEEE MASS 2025, as well as geometric algebra-informed neural radiance fields (NeRFs) and 3D Gaussian splatting methods for generalizable wireless channel prediction, which appeared in IEEE INFOCOM 2026 and IEEE/CVF CVPR 2026, respectively.

**Smart Health Monitoring Systems.** Smart health monitoring is an important IoT application area, particularly for vital sign monitoring and human activity recognition (HAR). We develop AI-driven sensing techniques that are low-cost, contact-free, and broadly accessible. Along this direction, we have designed RF-based, sensor-based, and acoustic sensing systems for smart health applications. For example, PhaseBeat uses Wi-Fi CSI phase-difference data to estimate breathing rate and heart rate, achieving median errors of 0.25 bpm and 1 bpm, respectively. To improve robustness in dynamic environments, we have developed RFID-based vital sign monitoring systems, including generative model-based breathing and heartbeat monitoring, as well as tensor-decomposition-based respiration monitoring in driving environments, which received the 2022 Best Journal Paper Award from the IEEE ComSoc eHealth Technical Committee. Recently, we have extended this research to privacy and interpretability in HAR, with work on membership inference in self-supervised HAR sensing

appearing in ACM SenSys 2025, privacy-preserving Wi-Fi data generation in IEEE INFOCOM 2025, and mechanistic interpretability for Transformer-based HAR sensing models under major revision at IMWUT 2026.

**Wireless IoT Device Security.** The proliferation of IoT has accelerated the integration of wireless technologies into daily life, while also introducing critical security challenges such as device identification and authentication. Although conventional cryptographic authentication methods based on Internet Protocol (IP) and Media Access Control (MAC) addresses have been widely used, they remain vulnerable to spoofing and tampering and may be unsuitable for ultra-low-power IoT devices or legacy hardware. To address these limitations, radio frequency (RF) fingerprinting has emerged as a promising device identification approach that leverages the intrinsic hardware characteristics of RF devices to enhance wireless security. In this direction, we designed a customized loss function and developed a Local Interpretable Model-agnostic Explanations (LIME)-based data augmentation technique for RF fingerprinting, demonstrating strong cross-domain performance with an accuracy improvement of approximately 80% over convolutional neural networks in the best case. This work appeared in IEEE INFOCOM 2024. We further analyzed the vulnerability of deep neural network-based RF fingerprinting systems to backdoor attacks and evaluated potential defense strategies, showing the difficulty of fully defending against such attacks. This line of work appeared in IEEE INFOCOM 2024, IEEE INFOCOM 2025, and IEEE Transactions on Mobile Computing (TMC) in 2025 and 2026. We also proposed a generalizable and interpretable RF fingerprinting framework using shapelet-enhanced large language models, under review at IEEE TMC.

Looking ahead, I will continue to advance AI-driven wireless systems for IoT applications and security. My future research directions include the following.

**(i) Enabling Generative, Robust, and Interpretable Wireless Intelligence for RF Spectrum Foundations and Applications.** This project aims to develop AI-native wireless intelligence by integrating generative, robust, and interpretable machine learning methods with RF sensing, channel modeling, and spectrum applications. The research is organized into four integrated thrusts. First, it develops spectrum data synthesis and augmentation methods by leveraging recent advances in generative models to address the need for sufficient high-quality labeled data. Second, it investigates domain generalization for wireless sensing and spectrum applications, focusing on foundation models, uncertainty estimation, and domain-invariant wireless feature representations. Third, it advances interpretable wireless intelligence by developing interpretable models for spectrum applications and improving the understanding of RF spectrum learning and generalization. Fourth, it integrates, validates, and evaluates these methods through in-depth studies of three RF spectrum applications, including RF fingerprinting, wireless sensing, and channel prediction. *This NSF CAREER project has been recommended for funding.*

**(ii) Statistically Grounded Digital Twins for Parkinson's Disease: A Unified Multi-Modal Machine Learning Framework.** This project aims to investigate foundational research problems and develop novel machine learning and statistical modeling techniques to enable a dynamic, interpretable, and privacy-preserving digital twin framework for Parkinson's disease (PD). By integrating multi-modal data sources, the project seeks to construct patient-specific computational models that capture real-world PD trajectories and support personalized clinical decision-making. The research agenda consists of four closely integrated thrusts: developing generative models and statistical foundations for multi-modal digital twin systems; developing statistically grounded learning methods for robust Parkinson's data analysis; designing privacy-preserving and explainable models for Parkinson's data analysis; and evaluating the proposed digital twin framework using real-world, large-scale PD data. This project will be submitted to the NSF FDT-BioTech program.

**(iii) Secure and Privacy-Preserving Wireless and IoT Systems.** Wireless and IoT security will remain a major research focus. First, we will investigate reconfigurable intelligent surface (RIS)-enabled secure and privacy-preserving Wi-Fi sensing infrastructure for healthcare monitoring, aiming to address security and privacy threats across the physical, signal, data, and model layers. Second, we will explore electromagnetic (EM) signal attacks and defenses for AI agents, model extraction, biometric authentication, and privacy protection. These research directions are expected to lead to future submissions to the NSF SaTC and CICI programs. Together, these efforts will advance next-generation AI-driven wireless sensing systems that are intelligent, trustworthy, and scalable, enabling transformative applications in 6G, healthcare, cybersecurity, and beyond.

# Teaching Statement

Xuyu Wang (xuywang@fiu.edu)

My goal in teaching is to help students build a rigorous technical foundation while developing a strong understanding of the societal impact of technology in real-world contexts. I believe effective teaching goes beyond transmitting knowledge; it should cultivate students' ability to think critically, solve problems independently, and apply theory to practice. Guided by this philosophy, I am well prepared to contribute to foundational computer science courses, such as mobile and wireless networks, as well as advanced courses in machine learning, wireless security, edge AI, and trustworthy AI.

**Teaching Philosophy:** My main teaching philosophy focuses on three aspects. First, conveying core concepts effectively. The foundation of learning lies in mastering fundamental principles and theories. My goal is to present these concepts clearly and rigorously so that students can develop a strong technical foundation. To achieve this, I will use instructional tools such as flow charts, diagrams, tables, and videos that transform abstract material into accessible and engaging content. Second, fostering student engagement. I believe that an interactive and inclusive classroom environment is essential for effective learning. Encouraging participation helps students remain attentive, particularly in online or hybrid settings where distractions are common. I will invite students to ask questions during class, which not only clarifies their understanding but also creates a dynamic atmosphere where curiosity is encouraged. Third, integrating theory with practice. True mastery occurs when students can apply their knowledge to real-world problems. I emphasize hands-on learning by designing projects that require students to implement and test systems using the concepts covered in class. This approach bridges the gap between theory and application and prepares students for future challenges in both academia and industry. Together, these three aspects of clarity, engagement, and practice form the cornerstone of my teaching philosophy.

**Teaching Experience:** Since joining FIU, I have revised and taught four graduate and undergraduate courses, including Advanced Topics in Machine Learning, Telecommunications Technology and Applications, Mobile and Wireless Networks, and Data Communications, while continuously integrating recent research advances and emerging technologies into the curriculum. I have also developed a new graduate course, Edge Artificial Intelligence: Models, Systems, and Applications, which addresses the growing importance of efficient, trustworthy, and deployable AI systems for edge computing, wireless networks, smart health, and IoT applications. My teaching record demonstrates both breadth and effectiveness, as reflected by an overall SPOTS rating of 4.26/5 from Fall 2022 to the present.

I have revised and developed my course portfolio at FIU to reflect both foundational knowledge and emerging research trends. In Spring 2023, I redesigned TCN 5010: Telecommunications Technology and Applications to provide students with a strong foundation in telecommunications, higher-level protocols, wireless networks, and emerging applications. The course integrates two hands-on homework assignments, a class project, student presentations, and a final exam. To expose students to current research, I ask them to study and present papers from top conferences, followed by class discussions that encourage critical thinking, peer learning, and deeper engagement with the literature. The course covers state-of-the-art telecommunications technologies and applications, including data networks, network and IoT security, edge computing, video streaming and analysis, federated learning, wireless systems and sensing, LTE/5G, AI security, deep learning for data networking and wireless communications, as well as next-generation topics such as quantum and semantic communications, satellite networks, and open RAN.

In Spring 2025, I redesigned CAP 6619: Advanced Topics in Machine Learning to incorporate recent advances in deep learning and real-world AI applications. The course introduces students to core concepts, modern techniques, and emerging directions in advanced machine learning and deep learning. It includes two hands-on homework assignments, research paper presentations, and a class project, allowing students to develop both theoretical understanding and practical implementation skills. Topics include advanced deep learning methods, computer vision models, sequence models, meta-learning, self-supervised learning, large language models, deep generative models, federated learning, and trustworthy artificial intelligence. Through paper

discussions and project-based learning, students learn to critically evaluate recent research, implement modern AI models, and apply machine learning techniques to real-world problems.

I also updated TCN 6270: Mobile and Wireless Networks in Spring 2025 to incorporate recent developments in mobile computing, wireless networks, IoT systems, and AI-enabled wireless applications. The course provides students with fundamental concepts, principles, and applications of advanced data communication, wireless, mobile, and IoT systems. Course topics include wireless physical-layer concepts and designs, mobile computing on smartphones, smart health, wireless localization, acoustic sensing, radar sensing, Wi-Fi sensing, low-power IoT systems such as RFID and LoRa, LTE and 5G/6G networks, deep learning for wireless systems, mobile computing, IoT applications and security, and emerging mobile, edge, and LLM-based AI systems. This course helps students connect wireless networking fundamentals with cutting-edge research and practical applications.

In Spring 2026, I designed a new graduate course, CIS 5931: Edge Artificial Intelligence: Models, Systems, and Applications, to address the growing importance of efficient, trustworthy, and deployable AI systems for edge computing environments. The course introduces the principles, algorithms, and systems needed to design and deploy modern AI models on resource-constrained and distributed edge platforms. Topics include deep learning foundations, data and system challenges in Edge AI, generative models, transformers, large language models, agentic and multimodal AI, federated learning, efficient deep learning, foundation models on the edge, physics-informed AI, embodied AI, and emerging applications in wireless systems, wireless sensing, smart health, security, and privacy. Students will read and discuss recent research literature, present technical topics, and complete an individual or team project to develop an end-to-end Edge AI system, helping them gain practical experience with modern AI deployment challenges.

**Mentorship**: I have maintained a balanced and inclusive mentoring portfolio across Ph.D., M.S., undergraduate, REU, and K–12 students, providing research training, supporting scholarly publications, and helping students develop the technical skills, professional confidence, and career readiness needed for success in academia, industry, and advanced study. My mentoring follows a task-based and student-centered approach that helps students gradually build research independence while making steady progress on important problems in wireless sensing, wireless security, smart health, edge AI, and trustworthy AI. I first identify a meaningful research direction, define the core technical challenges, and divide the project into smaller, achievable tasks tailored to each student's background, experience, and interests. Through regular check-ins, I review students' progress, update the task list based on experimental results, provide timely feedback, and offer technical guidance when students encounter difficulties, while also encouraging independent exploration and critical thinking.

Since joining FIU, I have advised multiple Ph.D. students, including Tianya Zhao, who has published three first-author IEEE INFOCOM papers, one ACM SenSys paper, and two first-author IEEE Transactions on Mobile Computing papers and is expected to graduate in Summer 2026; Jingzhou Shen, who has published first-author work at IEEE INFOCOM and CVPR; Yiting Wang; and Chuan Liu. I also mentor M.S. students, including Luis Lago Enamorado and Rohan Kumar, serve on multiple Ph.D. committees, and actively support undergraduate, REU, and K–12 students, including Jason Jiang and Jacob Van from FIU, Ben Abraham from Kean University, Yanelli Gloria from the University of California, Santa Cruz, and Bolin Xiang from Bridgeland High School, who will begin her undergraduate studies at Carnegie Mellon University in Fall 2026. Through my mentoring activities and NSF-supported projects, I have advanced Broadening Participation in Computing (BPC) by engaging underrepresented minority, female, and first-generation students in research and outreach. For example, I hosted an NSF BPC workshop at FIU from July 1 to July 8 in 2024, involving 13 K–12 teachers and 8 REU students through seven talks and one wireless spectrum project. Also, I have contributed to broader educational and professional training through invited tutorials and leadership activities, including organizing AI health tutorials at CVPR 2020, ICC 2022, and CVPR 2022–2025, organizing a special session at IEEE BHI 2021, and delivering a keynote speech at CVPM 2020.

Together, these activities demonstrate the breadth, effectiveness, and national and international visibility of my teaching, mentoring, and curriculum development efforts, as well as my commitment to providing structured guidance, timely feedback, technical depth, and an inclusive research environment that enables students to grow into independent researchers and contribute meaningfully to high-impact computing and engineering research.

# Service Statement

Xuyu Wang (xuywang@fiu.edu)

Service is an essential part of my academic identity and reflects my commitment to advancing my profession, supporting my institution, and contributing to the broader computing, wireless, artificial intelligence (AI), and smart health communities. Since beginning my faculty career, I have developed a sustained record of service at the institutional, national, and international levels. My service activities include school and university committee work, editorial leadership for major journals, organization of IEEE and ACM conferences and workshops, federal agency review panels, technical program committee service, and student-facing community engagement. Together, these activities demonstrate my commitment to strengthening academic programs, supporting students and colleagues, advancing my research communities, and enhancing FIU's visibility in wireless sensing systems, wireless security, trustworthy AI, smart health, and edge computing.

**Service at FIU:** I have been committed to institutional service that supports the mission of the Knight Foundation School of Computing and Information Sciences (KFSCIS) and contributes to graduate education, research engagement, and interdisciplinary collaboration. Since Fall 2024, I have served as the KFSCIS Seminar Series Coordinator, helping organize research seminars that bring scholars, researchers, and practitioners to FIU. This role provides students and faculty with opportunities to engage with current research trends, interact with external experts, and build professional networks. I also serve on the KFSCIS Graduate Program Committee beginning in Fall 2024, where I contribute to graduate education, curriculum development, program improvement, and student success. Moreover, I participate in CIERTA at FIU beginning in Fall 2024 and the Population Health Initiative at FIU beginning in Spring 2025. These activities reflect my interdisciplinary engagement with trustworthy AI, wireless sensing, and smart health research, and they allow me to connect my expertise in computing and wireless systems with university-wide efforts that address important societal challenges.

I have served on committees that directly support student recruitment, graduate education, and program development. From Fall 2022 to Summer 2024, I served on the Ph.D. Admission Sub-Committee, where I contributed to the review and evaluation of doctoral applicants. From Fall 2022 to Fall 2024, I served on the M.S.-TCN Program Sub-Committee, supporting the telecommunications graduate program and contributing to its continued development. These roles are closely aligned with my expertise in wireless networks, telecommunications, and AI-enabled communication systems. Beyond committee work, I have contributed to student-facing and community-oriented service activities as a judge or mentor for the KFSCIS Capstone Showcase, TechTogether Miami, and REU poster and demo sessions. These activities provide valuable opportunities to support student innovation, mentor early-stage researchers, and encourage broader participation in computing and engineering.

**External Service:** A major component of my professional service is editorial and review leadership. I currently serve as an Associate Editor for IEEE Transactions on Mobile Computing, one of the flagship journals in mobile computing, wireless networking, and pervasive systems. In this role, I help coordinate the peer-review process, evaluate the technical quality and significance of submitted manuscripts, work with reviewers, and make editorial recommendations that support the rigor and impact of the journal. This service directly aligns with my expertise in wireless sensing, mobile computing, IoT, and AI-enabled wireless systems. I also previously served as an Associate Editor for Digital Communications and Networks from 2021 to 2022. In addition, I served as Guest Editor for the ACM Transactions on Sensor Networks Special Issue on Contact-free Smart Sensing in AIoT from 2022 to 2023, contributing to the development of an emerging research area at the intersection of AIoT, wireless sensing, and smart health. I also served as editor of the Elsevier book Contactless Vital Sign Monitoring from 2019 to 2021, reflecting my long-standing commitment to interdisciplinary research in wireless sensing and healthcare applications. This is the first book to systematically introduce different contactless and wireless sensing technologies (e.g. camera, radar, Wi-Fi, acoustics, RFID, etc.) for vital signs monitoring and healthcare applications.

Beyond formal editorial appointments, I have provided sustained peer-review service for leading journals across networking, wireless communications, artificial intelligence, multimedia, industrial informatics, biomedical engineering, and IoT. I have regularly reviewed manuscripts for journals such as IEEE/ACM Transactions

on Networking, IEEE Transactions on Neural Networks and Learning Systems, IEEE Transactions on Mobile Computing, IEEE Journal on Selected Areas in Communications, IEEE Transactions on Vehicular Technology, IEEE Transactions on Wireless Communications, IEEE Transactions on Multimedia, IEEE Transactions on Industrial Informatics, IEEE Journal of Biomedical and Health Informatics, IEEE Internet of Things Journal, IEEE Communications Magazine, IEEE Network, and IEEE Communications Letters, among others. This reviewing activity allows me to contribute to the quality, fairness, and technical development of the broader research community while remaining engaged with emerging directions in wireless systems, AI, smart health, security, and next-generation communications.

I have also taken on significant conference and professional leadership roles that support the growth of research communities in AI-enabled wireless systems, wireless security, smart health, and communications. I have served as TPC co-chair of the IEEE INFOCOM Workshop on Deep Learning for Wireless Communications, Sensing, and Security, also known as DeepWireless, from 2023 to 2026. I have also served as TPC co-chair of the IEEE ICC/GLOBECOM Workshop on Machine Learning and Deep Learning for Wireless Security from 2024 to 2026. These roles require developing technical themes, recruiting program committee members, managing the review process, coordinating paper decisions, and helping build strong technical programs. Through these efforts, I have contributed to shaping emerging research directions in AI-driven wireless communications, wireless sensing, and wireless security.

My broader conference leadership includes serving as symposium co-chair for the AI and Machine Learning for Communications and Networking Symposium at IEEE ICNC 2025 and 2026, tutorials co-chair for IEEE CCNC 2024, workshop co-chair for IEEE HealthCom 2024, demo/posters co-chair for IEEE HealthCom 2026, publicity co-chair for IEEE/ACM CHASE 2023, and EDAS and Publications co-chair for IEEE MILCOM 2025. I have also co-chaired the IEEE/ACM CHASE 2025 Workshop on Generative AI for Smart and Connected Health: Innovations, Challenges, and Applications and the IEEE/ACM CHASE 2026 Workshop on Generative AI for Smart Health and Biomedical Informatics. These leadership roles demonstrate the breadth of my professional service across wireless communications, mobile computing, smart health, AI, security, and interdisciplinary computing. They also allow me to help create venues where researchers can exchange ideas, present new results, and form collaborations across academia, industry, and government.

In addition to conference organization, I have contributed to the national research enterprise through panel and agency review service. I have served as an NSF panelist in 2021, 2024, and twice in 2026, and as a Department of Energy (DOE) panelist in 2024. I also served as a panelist for ACM WiseML 2022. These activities support the rigorous and fair evaluation of research proposals and help federal agencies identify promising scientific directions. Serving on these panels has also broadened my perspective on emerging research priorities across computing, wireless systems, AI, cybersecurity, and interdisciplinary applications.

I have provided extensive technical program committee service for major IEEE, ACM, and interdisciplinary venues. I have served on program committees for leading conferences and workshops, including IEEE INFOCOM, IEEE MASS, IEEE GLOBECOM, IEEE ICC, IEEE ICCCN, AAAI, and IEEE HealthCom. I was recognized as *a Distinguished Member of the 2026 INFOCOM Technical Program Committee*. I have also served as a session chair for IEEE CNS 2023, IEEE/ACM CHASE 2023, and IEEE MASS 2022. Through these roles, I have supported rigorous peer review, facilitated conference operations, and promoted the dissemination of high-quality research in wireless networking, mobile computing, AI, cybersecurity, and smart health.

Overall, my service record demonstrates sustained leadership across institutional, professional, and community domains. At FIU, I have contributed through seminar coordination, graduate program development, admissions activities, interdisciplinary initiatives, and student-facing service. Professionally, I have provided leadership through editorial service, journal reviewing, conference and workshop organization, federal agency panel service, technical program committee participation, and session chairing. These contributions have helped advance my research communities, strengthen FIU's academic programs, and support the development of students and early-career researchers. Moving forward, I will continue to expand my service leadership at FIU and across the broader IEEE, ACM, wireless sensing, AI, cybersecurity, and smart health communities, with the goal of enhancing the visibility, impact, and excellence of both my institution and my profession.