Zifan Zhang

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RESEARCH INTERESTS

Digital network twins for wireless, vehicular, and HPC networks, with emphasis on **mapping** (cross-system representation and calibration), physical-digital **synchronization**, and **security/robustness** against adversarial behaviors.

EDUCATION

NORTH CAROLINA STATE UNIVERSITY — Raleigh, NC
Ph.D. in Computer Science, Expected 2027
- Networking & IntelligenCE (NICE) Lab advised by Dr. Yuchen Liu

THE OHIO STATE UNIVERSITY — Columbus, OH
Master of Science in Electrical and Computer Engineering, May 2023
- Networked Intelligence Research Group advised by Dr. Jia (Kevin) Liu
- Thesis: Communication Efficiency and Security for Multi-Agent Reinforcement Learning

THE OHIO STATE UNIVERSITY — Columbus, OH
Bachelor of Science in Electrical and Computer Engineering, May 2021

APPOINTMENTS & RESEARCH EXPERIENCE

NORTH CAROLINA STATE UNIVERSITY — Raleigh, NC
Graduate Research Assistant, Advisor: Dr. Yuchen Liu — *2023 - Present*
- Developed distributed network digital twins for reliable caching with joint vertical and horizontal mapping.
- Proposed inter- and intra-twin operation framework for multi-modal network digital twins to enhance efficiency.
- Designed and evaluated robust defense strategies against data and model poisoning attacks.
- Mentored 2 M.S. students on twin construction and synchronization, resulting in a submission to IPDPS.

OAK RIDGE NATIONAL LABORATORY (ORNL) — Oak Ridge, TN
Research Intern, Mentor: Dr. Wes Brewer — *2025 - Present*
- Developed the core technical approach and led its implementation; served as primary presenter and technical lead in recurring ORNL project meetings.
- Led the experimental evaluations on exascale digital twins (evaluation design, implementation, analysis) and iterated based on team feedback.
- Co-authored a submission to SC and contributed to internal milestones for ExaDigit, a digital twin framework for liquid-cooled supercomputers.

HONORS AND AWARDS

- IFIP/IEEE Networking Conference Best Paper Award Runner-up — 2024
- NC State College of Engineering Graduate Merit Award — 2024

PUBLICATIONS

Selected Publications

1. **Z. Zhang**, Y. Liu, Z. Peng, M. Chen, D. Xu, S. Cui, "Digital Twin-Assisted Data-Driven Optimization for Reliable Edge Caching in Wireless Networks", *IEEE Journal on Selected Areas in Communications (JSAC)*[J], 2024.
2. **Z. Zhang**, M. Fang, J. Huang, Y. Liu, "Poisoning Attacks on Federated Learning-based Wireless Traffic Prediction", *IFIP/IEEE Networking Conference*, 2024. (**Best Paper Award Runner-up 2/195**)

3. **Z. Zhang**, Z. Peng, H. Yu, M. Chen, Y. Liu, "Digital Network Twins for Next-Generation Wireless: Creation, Optimization, and Challenges", *IEEE Network Magazine*, 2025.

Journal Papers

1. **Z. Zhang**, M. Fang, M. Chen, G. Li, X. Lin, and Y. Liu, "Securing Distributed Network Digital Twin Systems Against Model Poisoning Attacks", *IEEE Internet of Things Journal (IoT-J)* [J], 2024.

Conference Papers

1. **Z. Zhang**, M. Fang, M. Chen and Y. Liu, "On Transferring, Merging, and Splitting Task-Oriented Network Digital Twins", *International Symposium on Mobility Management and Wireless Access*, 2025.
2. W. Wang, Q. Ma, **Z. Zhang**, Y. Liu, Z. Liu and M. Fang, "Poisoning Attacks and Defenses to Federated Unlearning", *The Web Conference*, 2025.
3. **Z. Zhang**, M. Chen, Z. Yang, Y. Liu, "Mapping Wireless Networks into Digital Reality through Joint Vertical and Horizontal Learning", *IFIP/IEEE Networking Conference*, 2024.
4. M. Fang, **Z. Zhang**, Hairi, P. Khanduri, J. Liu, S. Lu, Y. Liu, Z. Gong, "Toward Byzantine-Robust Decentralized Federated Learning", *ACM Conference on Computer and Communications Security (CCS)*, 2024.
5. Hairi, **Z. Zhang**, J. Liu, "Sample and Communication Efficient Fully Decentralized MARL Policy Evaluation via a New Approach: Local TD update", *International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, 2024.
6. Hairi, M. Fang, **Z. Zhang**, A. Velasquez, J. Liu, "On the Hardness of Decentralized Multi-Agent Policy Evaluation under Byzantine Attacks", *IEEE/IFIP International Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOpt)*, 2024.

Magazine Articles

1. **Z. Zhang**, M. Fang, D. Chen, X. Yang, Y. Liu, "Synergizing AI and Digital Twins for Next-Generation Network Optimization, Forecasting, and Security", *IEEE Wireless Communication*, 2025.

Under Review / Preprints

1. **Z. Zhang**, M. Fang, D. Chen, X. Yang, Z. Liu, Y. Liu, "Securing Autonomous Vehicle Systems via Twin-Aware Federated Reinforcement Learning", *Under review*, 2025.
2. **Z. Zhang,** W. Brewer, F. Wang, Y. Liu, "Enabling Topology-Aware HPC Analysis via Trace-Inferred Virtual Network Representation", *Under review*, 2025.
3. **Z. Zhang,** D. Chen, M. Wang, M. Chen, M. Fang, X. Yang, Y. Liu, "Network Digital Untwinning: Towards Backward Optimization of Digital Twins", *Under review, 2025*.

GRANT PROPOSAL EXPERIENCE

"Two Faces of Safeguarding: Securing Forward and Backward Continual Learning Process in Hierarchical Digital Twin Systems" (Submitted to NSF SaTC 2.0: RES (Collaborative Research))
Proposal contributor (graduate student)
- Drafted initial technical narrative for system model & motivation (e.g., Sec. 1.1) and research plan.
- Drafted initial writeups for Thrust/Tasks on backward learning (e.g., Task 2.2).
- Created all proposal figures, including system overview and thrust/task workflows, and iterated with PI feedback.
- Drafted initial version of Section 3 (e.g., project management / coordination plan), later revised by advisor.

TEACHING EXPERIENCE

Teaching Assistant, North Carolina State University
Fall 2023 – Spring 2024
- CSC 505: Design and Analysis of Algorithms — held office hours; supported grading and exam preparation.

- CSC 230: C and Software Tools — held office hours; graded programming assignments.

Teaching Assistant, The Ohio State University
Fall 2021 – Spring 2023
- ECE 3561: Advanced Digital Design — supported lab instruction and grading; assisted with project troubleshooting; graded homework/exams.
- ECE 5101: Wireless Networks — held office hours; graded homework/exams.

STUDENT MENTORING

Soham Sawant (M.S. student @NC State) — co-mentored on topology-aware predictive analysis for large-scale HPC system; produced a submission to IPDPS (submitted).
Leo Wang (B.S./M.S. student @NC State) — co-mentored on physical-digital synchronization for Open RAN system.

INVITED TALKS

Digital Network Twins
ATS Seminar Series, Oak Ridge National Laboratory (ORNL), Oak Ridge, TN, 2025.
Digital Network Twins for HPC Systems
Digital Twins Workshop for High-Performance Computing, SC25, 2025.

PROFESSIONAL SERVICES

University Services
- Search Advisory Committee for Department Head of Computer Science, North Carolina State University, 2025

Conference Reviewer
- IEEE Intelligent Vehicles Symposium (IV) 2026
- ACM International Conference on Modeling, Analysis and Simulation of Wireless and Mobile Systems (MSWIM) 2025
- IEEE Conference on Network Functions Virtualization and Software-Defined Networking (IEEE NFV-SDN) 2025
- IEEE International Conference on Intelligent Transportation Systems (ITSC) 2025
- IEEE Symposium on Computers and Communications (ISCC) 2025
- IEEE International Conference on Communications (ICC) 2025
- IEEE Consumer Communications & Networking Conference (CCNC) 2025
- IEEE Conference on Local Computer Networks (LCN) 2024

Journal Reviewer
- IEEE Transactions on Neural Networks and Learning Systems (TNNLS)
- IEEE Transactions on Communications (TCOM)
- IEEE Journal on Selected Areas in Communications (JSAC)
- Transactions on Information Forensics & Security (TIFS)
- IEEE Transactions on Mobile Computing (TMC)
- IEEE Transactions on Network Science and Engineering (TNSE)
- IEEE Transactions on Vehicular Technology (TVT)
- IEEE Transactions on Green Communications and Networking (TGCN)
- Springer Nature Journal of King Saud University Computer and Information Sciences
- Springer Nature The Journal of Supercomputing
- Springer Nature Cluster Computing

TECHNICAL SKILLS

Programming Languages: Python, C/C++, SQL, Java, MATLAB, R, Assembly Language, VHDL
System Tools: ns-3, Wireless Insite, Wireless Shark, Omniverse, SionnaRT, CARLA, SUMO, OpenStreetMap
Machine Learning Tools: PyTorch, Tensorflow, Keras, OpenAI Gym, HuggingFace, Scikit-learn