Zhutian Liu

ztliu.com

Email: zhutian.liu@email.ucr.edu
Mobile: +1-951-419-1026

Research Interests

Ph.D. candidate in Computer Science and Engineering. I have broad interests and experience in real **network systems**, from developing deep vision models to mitigating vulnerabilities in Wi-Fi. My research focuses on identifying *performance factors* in deployment and developing *practical optimization* techniques. My expertise includes:

- **Wireless Security:** 802.11 security analysis and Open RAN system testing.
- **5G Cellular Networks:** 5G protocol stack and Open RAN architecture.
- **TCP/IP Networking:** Transport-layer protocols, congestion control, and network measurement.
- **Video Streaming:** Adaptive video delivery (DASH/HLS) and real-time streaming (WebRTC).
- **Video Coding & Computer Vision:** Conventional and neural video codecs.
- **Machine Learning:** Transformers and other deep neural networks.

Education

Ph.D. in Computer Science and Engineering — Jan 2021 – Sep 2027
University of California, Riverside. Advisor: Zhaowei Tan — *Riverside, USA*

B.S. in Computer Science and Technology, Minor in Mathematics — Sep 2016 – Jun 2020
University of Electronic Science and Technology of China — *Chengdu, China*

Professional Experience

Graduate Student Researcher — Jan 2021 – Present
University of California, Riverside — *Riverside, USA*

Student Research Intern — Aug 2018 – Oct 2018
Tencent — *Chengdu, China*

Selected Projects

[P.9] Video Forgery Attack and Mitigation over Unreliable Transmission [U.3]
C/C++, Python, Go, WebRTC, Chromium, 802.11
- Automated measurement framework that aggregates information from video, application and transport
- Analyzed root causes of degraded vision model performance over Wi-Fi
- Designed conditioning layers that modulate model output based on Wi-Fi telemetry
- Implemented and validated attack and mitigation techniques in commercial browsers

[P.8] Bandwidth-Efficient Federated Learning [U.2]
Python, QUIC, Federated Learning, Wi-Fi
- Learned client update redundancy and network contention from telemetry
- Enforce allocation at server-side only via transport layer flow control
- Implement and evaluate solution in Wi-Fi / Cellular networks

[P.7] Internet Traffic Synthesis for Intrusion Detection [U.1]
Python, TCP/IP, Sequence Models, Network Measurement
- Designed a lightweight traffic synthesizer combining protocol knowledge with a compact model
- Reduced archival storage to ˜2% and learned millions+ packets under an hour
- Evaluate downstream classifier and DDoS detector on real internet traffic

[P.6] Cross-Layer Measurement Framework for HTTP Adaptive Streaming over 5G
C/C++, JavaScript, Python, TCP/IP, QUIC, HTTP, 5G
- An end-to-end DASH measurement framework, from video encoding to playback
- Customized *dash.js* and measured video QoE and internal ABR metrics
- Collected transport-layer congestion control metrics and 5G link-layer metrics

[P.5] ARCANE: Model-Based Fuzzing for 5G O-RAN Conformance [C.2]
C/C++, Python, TLA+, Docker
- A systematic test suite leveraging LLM-assisted specification analysis to identify cross-interface procedures
- Auto-generated conformance test cases from operation traces for crucial procedures
- Evaluated the F1AP protocol on *OpenAirInterface*; uncovered 149 unique bugs across 9 categories

[P.4] M2HO: An In-Depth Study of 5G Handover Impact on TCP Performance [C.1]
C/C++, TCP/IP, 5G
- A study into TCP performance anomalies induced by 5G handover mechanisms
- Designed a client-side adaptive TCP enhancement via a Linux Netfilter module
- Developed an Android-based emulator reproducing real handover traces for evaluation

[P.3] Cross-Interface Spoofing Attack between Wi-Fi Clients [C.3]
Python, ARP, 802.11
- A MITM attack that hijacks client traffic from other Wi-Fi interfaces
- Successfully performed the attack on enterprise hardware
- Apple (iOS, macOS, etc.): **CVE-2026-20671** – cross-layer client-side MITM
- HPE Aruba (AOS-8/10): **CVE-2026-23601**, **CVE-2026-23808 to 23812** – GTK abuse, port stealing

[P.2] Proxy for Fast Bulk Downloading over Lossy Networks
C/C++, TCP/IP, HTTP
- An HTTP proxy boosting download speed in metered networks with artificial packet loss
- Proposed a strategy that uses redundancy to skip-ahead while downloading in parallel
- Implemented as a transparent proxy on top of *Squid*

[P.1] Mobile LoRa Gateway for Off-Grid Agricultural Sensing
Docker, C, Python, LoRaWAN
- Designed a portable LoRaWAN gateway setup for off-grid telemetry
- Implemented gateway on a Raspberry Pi mounted on a UAV, collaborated with DAF mentees

Publications

Under review.

[U.3] **Video Forgery Attack and Mitigation over Unreliable Transmission [P.9]**

[U.2] **Bandwidth-Efficient Federated Learning [P.8]**

[U.1] **Internet Traffic Synthesis for Intrusion Detection [P.7]**

Conference, **W**orkshop.

[W.2] **AirSnitch: Breaking Client Isolation in Wi-Fi Networks [P.3]**
Black Hat Asia 26 *M. Vanhoef, Z. Qian, X. Zhou, J. Pu, Z. Liu, Z. Tan, S. V. Krishnamurthy*
Black Hat Asia 2026

[C.3] **AirSnitch: Demystifying and Breaking Client Isolation in Wi-Fi Networks [P.3]**
NDSS 26 *X. Zhou, J. Pu, Z. Liu, Z. Qian, Z. Tan, S. V. Krishnamurthy, M. Vanhoef*
Network and Distributed System Security (NDSS) Symposium, 2026

[C.2] **Automated Model-Based Fuzzing for 5G O-RAN [P.5]**
MobiCom 25 *S. Tan, Z. Li, Z. Liu, H. Patel, Z. Tan*
ACM International Conference on Mobile Computing and Networking (MobiCom), 2025

[C.1] **M2HO: Mitigating the Adverse Effects of 5G Handovers on TCP [P.4]**
MobiCom 24 *Z. Liu, Q. Deng, Z. Tan, Z. Qian, X. Zhang, A. Swami, S. V. Krishnamurthy*
ACM International Conference on Mobile Computing and Networking (MobiCom), 2024

[W.1] **DU-level UE Context Migration [P.4]**
MobiCom 24 *Presenter: Z. Liu*
ACM Open-AI RAN 2024 Workshop

Skills

- **Languages**: C/C++, Python, Bash, Lisp, Go
- **Tools**: OpenCV, PyTorch, Docker, eBPF, ns-3, Android NDK, Git, Netfilter, Scapy
- **Knowledge**: TCP/IP, Security, WebRTC, Video Codecs, 5G, Linux, Machine Learning, Computer Vision

Services

- **Conference Reviewer**: ICPADS 2025, ACM S3 Workshop MobiCom 2026
- **Volunteer**: ACM CoNEXT 2025

Teaching Experience

Mentorship

- UR2PhD: Anthony Padilla, Claire Lu and Sethya Pugal – 5G energy measurement — Aug 2024 – Dec 2024
- DAF: Monse Lopez, Jooahn Park and Sofia Tapia – LoRaWAN sensing — Summer 2024, 2025

Teaching Assistant

- CS 169: Mobile Wireless Networks — Winter 2022, 2023, 2025
- CS 164: Computer Networks — Fall 2024
- CS 153: Design of Operating Systems — Spring 2025
- CS 178A: Project Sequence in CSE — Fall 2025