

Education

University of California, Riverside

P.h.D in Electrical Engineering, GPA: 3.71/4.00

Riverside, CA

2021.9–Current

- Advisor: Prof. Nael Abu-Ghazaleh

University of California, Irvine

M.S. in Computer Engineering, GPA: 3.78/4.00

Irvine, CA

2018.9–2021.6

- Thesis: “Stealing Deep Learning Model Secret through Remote FPGA Side-channel Analysis”
- Thesis Advisors: Prof. Mohammad Abdullah Al Faruque and Prof. Zhou Li

Sichuan University

B.S. in Electrical Engineering and Automation, GPA: 3.53/4.00

Chengdu, China

2014.9–2018.6

- Thesis: “Fault detection in power transmission system using Machine Learning”
- Thesis Advisor: Prof. Yang Liu

Professional Experience

Pacific Northwest National Laboratory

Research Intern at the Center for Advanced Technology Evaluation (CENATE)

Richland, WA

2023.6–2023.9

- Mentors: Dr. Kevin J. Barker, Dr. Andres Marquez, and Dr. Sankha Baran Dutta
- Topic: Microarchitecture Security in Multi-GPU Systems

University of California, Riverside

Research Assistant in Secure and Efficient Architectures and Systems (SEAS) Lab

Riverside, CA

2021.9–Current

- Mentor: Prof. Nael B. Abu-Ghazaleh
- Topic: AR/VR Security, Computer Architecture Support for Security

University of California, Riverside

Graduate Student Mentor in UCR Graduate Student Mentorship Program (GMSP)

Riverside, CA

2022.9–2023.6

- Mentor: Prof. Philip Brisk
- I worked with Prof. Philip Brisk to help first-year graduate students transition from undergraduate programs or careers into graduate study

University of California, Irvine

Teaching Assistant in Department of Electrical Engineering and Computer Science

Irvine, CA

2018.9–2021.6

- Assisted course instructors in course website design, grading, and lecturing

Peer-reviewed Publications

My research interest lies in **hardware security, AR/VR, side-channel attacks, and computer architecture.**

Full profile on Google Scholar: <https://scholar.google.com/citations?user=X3LwPLAAAAAJ&hl=en>

Conference Papers

- C5. **Yicheng Zhang**, Ravan Nazaraliyev, Sankha Baran Dutta, Nael Abu-Ghazaleh, Andres Marquez and Kevin Barker, “Beyond the Bridge: Contention-Based Covert and Side Channel Attacks on Multi-GPU Interconnect”, *In Proceedings of the 2024 IEEE International Symposium on Secure and Private Execution Environment Design (SEED)*, Orlando, FL, USA, January 2024.
- C4. Carter Slocum*, **Yicheng Zhang***, Erfan Shayegani, Pedram Zaree, Nael B. Abu-Ghazaleh, and Jiasi Chen, “That Doesn’t Go There: Attacks on Shared State in Multi-User Augmented Reality Applications”, *In Proceedings of the 33rd USENIX Security Symposium (Under review)*, Philadelphia, PA, USA, August 2024.
*Equal contribution.
- C3. Carter Slocum, **Yicheng Zhang**, Jiasi Chen, and Nael B. Abu-Ghazaleh, “Going through the motions: AR/VR key-logging from user head motions”, *In Proceedings of the 32nd USENIX Security Symposium (USENIX Security)*, Anaheim, CA, USA, August 2023.
- C2. **Yicheng Zhang**, Carter Slocum, Jiasi Chen, and Nael B. Abu-Ghazaleh, “It’s all in your head(set): side-channel attacks on augmented reality systems”, *In Proceedings of the 32nd USENIX Security Symposium (USENIX Security)*, Anaheim, CA, USA, August 2023.
- C1. Wei Junyi*, **Yicheng Zhang***, Zhe Zhou, Zhou Li, and Mohammad Abdullah Al Faruque, “Leaky DNN: Stealing Deep-Learning Model Secret with GPU Context-Switching Side-Channel”, *In 2020 50th Annual IEEE/IFIP International Conference on Dependable Systems and Networks (DSN)*, Valencia, Spain, June 2020.
*Equal contribution.

Journal Articles

- J1. **Yicheng Zhang**, Rozhin Yasaei, Hao Chen, Zhou Li and Mohammad Abdullah Al Faruque, “Stealing Neural Network Structure through Remote FPGA Side-channel Analysis”, *In IEEE Transactions on Information Forensics and Security (IEEE TIFS)*, August 2021.

Workshop Papers

- W1. **Yicheng Zhang**, Dhroov Pandey, Di Wu, Turja Kundu, Ruopu Li and Tong Shu, “Accuracy-Constrained Throughput Optimization and Performance Profiling of CNN Inference for Detecting Drainage Crossing Locations”, *In Proceedings of the SC’23 Workshops of The International Conference on High Performance Computing, Network, Storage, and Analysis (SC’23 Workshop)*, Denver, CO, USA, November 2023.

Posters

- P1. **Yicheng Zhang**, Rozhin Yasaei, Hao Chen, Zhou Li and Mohammad Abdullah Al Faruque, “Poster : Stealing Neural Network Structure through Remote FPGA Side-channel Analysis”, *In 29th ACM/SIGDA International Symposium on Field-Programmable Gate Arrays (FPGA)*, February 2021.

Teaching Experience

Teaching Assistant at University of California, Irvine <i>Organization of Digital Computers (EECS112)</i>	Spring 2021
Teaching Assistant at University of California, Irvine <i>Next Generation Search Systems (CS125)</i>	Winter 2021
Teaching Assistant at University of California, Irvine <i>Object Oriented System & Programming (EECS40)</i>	Fall 2020
Teaching Assistant at University of California, Irvine <i>System Software (EECS111)</i>	Spring 2020
Teaching Assistant at University of California, Irvine <i>Continuous-Time Signals and Systems (EECS150)</i>	Winter 2019

Presentations and Talks

1. “Accuracy-Constrained Efficiency Optimization and GPU Profiling of CNN Inference for Detecting Drainage Crossing Locations” at SC’23 Workshop, Denver, CO, USA, November, 2023
2. “It’s all in your head(set): side-channel attacks on augmented reality systems” at USENIX Security’23, Anaheim, CA, USA, August, 2023
3. “Poster: Stealing Neural Network Structure through Remote FPGA Side-channel Analysis” at FPGA’21, virtual, February 2021
4. “Leaky DNN: Stealing Deep-Learning Model Secret with GPU Context-Switching Side-Channel” at DSN’20, virtual, June 2020

Skills and Selected Courses

- **Programming:** C/C++, CUDA C++, C#, Python, Java, Verilog, TensorFlow, PyTorch, Linux (Bash), Assembly
- **Tools:** Altera Quartus, Xilinx Vivado/ISE, Vivado HLS, Jupyter Notebook
- **Softwares:** Matlab, Arduino, Unity, Unreal Engine, Android Studio
- **Selected Courses:** Autonomous Cyber-Physical Systems (A+), GPU Architecture & Parallel Programming (A), Advanced Operating Systems (A), Pattern Recognition (A), Advanced Computer Vision (A), Advanced System Security (A), Machine Learning & Artificial Intelligence (A)

Service and Professional Activities

Service to Profession - Program Committee

- TPC Member, International Conference on Emerging Information Security and Applications (EISA), 2023.
- TPC Member, International Workshop on Security (IWSEC), 2023.
- TPC Member, International Conference on Cyber-Technologies and Cyber-Systems (CYBER), 2021, 2022, 2023.
- TPC Member, International Conference on Edge Computing and IoT: Systems, Management and Security (EAI ICECI), 2024.

Service to Profession - Conference and Journal Reviewer

- Reviewer, IEEE International Conference on Industrial Cyber-Physical Systems (ICPS), 2020.
- Reviewer, EAI International Conference on Sec. and Pri. in Communication Networks (EAI SecureComm), 2023.
- Reviewer, IEEE Transactions on Information Forensics and Security (IEEE TIFS), 2023.
- Reviewer, Journal of Computer Security (JCS), 2023.
- Reviewer, IEEE Transactions on Computers (IEEE TC), 2023.
- Reviewer, International Journal of Applied Cryptography (IJACT), 2023.
- Reviewer, Security and Communication Networks (SCN), 2023.
- Reviewer, Journal of Systems Architecture (JSA), 2023.
- Reviewer, EURASIP Journal on Information Security (EURASIP JINS), 2023.

Other Activities:

- Artifact Evaluation, IEEE/ACM International Symposium on Microarchitecture (MICRO), 2022.
- Student Volunteer, IEEE International Symposium on Secure and Private Exe. Env. Design (SEED), 2024.

Research Projects

Contention-based Covert and Side Channel Attacks on Multi-GPU Systems

- Demonstrated contention-based covert and side channels attack on NVIDIA GPU's NVLink interconnect.
- The related paper is under review in **SEED 2024** [C5] (First author).

Shared State Attacks in Multi-User Augmented Reality Applications

- Demonstrated a series of innovative and robust attacks on multiple AR frameworks with shared states, focusing on three publicly accessible frameworks.
- Proposed several potential mitigation strategies that help enhance the security of multi-user AR applications.
- The related paper is under review in **Usenix Security 2024** [C4] (First author).

Accuracy-Constrained Efficiency Optimization for Detecting Drainage Crossing

- Demonstrated the efficacy of resource-aware Neural Architecture Search (NAS) in refining the hyperparameters of SPP-Net, leading to significant enhancements in inference efficiency.
- Performed comprehensive profiling of the drainage crossing detection models on GPU systems, pinpointing the performance bottlenecks unique to single GPU configurations.
- The related paper was accepted in **SC'23 Workshop** [W1] (First author).

AR/VR typing inference using head motion tracking

- Developed a system named **TyPose** that autonomously deduces words and characters typed by a user.
- Collected tens of user traces depicting AR/VR typing behavior and conducted a thorough evaluation of our attack on these traces, achieving a high level of accuracy.
- The related paper was accepted in **Usenix Security 2023** [C3].

Side-channel attacks on Mixed Reality systems via Rendering Performance Counters

- Introduced a taxonomy outlining potential targets and sources of leakage for software-based side-channel attacks on AR/VR systems.
- Demonstrated five end-to-end side-channel attacks across three distinct AR/VR-specific attack scenarios, achieving a high degree of accuracy.
- The related paper was accepted by **Usenix Security 2023** [C2] (First author).

Remote Side-Channel Attack on FPGA to Steal Neural Network Structure

- Developed a novel FPGA power side-channel-based attack on Machine learning models.
- Employed a range of classifiers including Nearest Neighbors, Gradient Boosting, Decision Tree, RandomForest, Neural Network, Naive Bayes, AdaBoost, and XGBoost to effectively recover hyper-parameters of the victim model from side-channel leakages.
- The related papers were accepted by **FPGA 2021** [P1] (First author) and **IEEE TIFS** [J1] (First author).

Model Stealing Attacks via GPU Context-Switching Side-Channel

- Developed a novel GPU side-channel based on context-switching penalties.
- Implementation of LSTM-based inference model to identify the structural secret of CNN models.
- The related paper was accepted by **IEEE DSN 2020** [C1] (First author).

Academic Supervision and Mentorship

Undergraduate Students

- | | |
|---------------------------|----------------------------------|
| • Gabriel Haresco | UCR CSE, 2023–Current |
| • Clarity Shimoniak | UCR CSE, 2023–Current |
| • Cheng Gu | UCR CSE, 2022–Current |
| • Xuchang Zhan | UCI EECS, 2019-2020, Now at VISA |
| • Kendus Tisdale-Jeffries | Alabama A&M, 2019 Summer |

Graduate Students

- Sriraksha Srirangapatna Arun
- Yuxin Qiu
- Ziyang Men

UCR CSE, 2023 Spring
UCR CSE, 2022–2023
UCR CSE, 2022–2023

Media Coverage

Side-channel attacks on AR/VR systems

- Reported by [UCR News](#), [ZME Science](#), [Tech Xplore](#), [Analytics Insight](#), [Gillett News](#), [Fagen Wasanni](#), [Analytics Insight](#), [Game Is Hard](#), [Knowridge](#), [Inside](#), 2023

Honors and Awards

- Student Travel Grant for DL-GPU Workshop 2023
- International Peer Educator Training Program Certification (IPTPC) Level 1 2023
- UCR GSA Conference Travel Grant 2023
- Student Travel Grant for gem5 Boot Camp 2022
- Student Travel Grant for IEEE Symposium on Security and Privacy 2021,2022
- Student Travel Grant for ACM Conference on Computer and Communications Security 2021
- Student Travel Grant for USENIX Security Symposium 2021
- Dean's Distinguished Fellowship Award (UC Riverside) 2021
- Sichuan University Scholarship (China) 2014–2018

Membership

IEEE Student Member, ACM Student Member.

Volunteering, Diversity & Inclusion

- **Volunteer** at IEEE International Symposium on Secure and Private Execution Environment Design (SEED) 2024
- **Mentor** at UCR Graduate Student Mentorship Program (GSMP) 2022-2023
- **Mentor** at UCR International Student Peer Mentor Program (ISPMP) 2022-2023
- **Mentor** domestic and international undergraduate students in UCI 2019-2020
- **Volunteer** at 120th Anniversary of Sichuan University 2016.9