Yicheng Zhang

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Education

University of California, Riverside — Riverside, CA
P.h.D in Electrical Engineering, GPA: 3.71/4.00 — 2021.9–Current
- Advisors: Prof. Nael Abu-Ghazaleh

University of California, Irvine — Irvine, CA
M.S. in Computer Engineering, GPA: 3.78/4.00 — 2018.9–2021.6
- Thesis: "Stealing Deep Learning Model Secret through Remote FPGA Side-channel Analysis"
- Thesis Advisor: Prof. Abdullah Al Faruque and Prof. Zhou Li

Sichuan University — Chengdu, China
B.S. in Electrical Engineering and Automation, GPA: 3.53/4.00 — 2014.9–2018.6
- Thesis: "Fault detection in power transmission system using Machine Learning"
- Thesis Advisor: Prof. Yang Liu

Professional Experience

University of California, Riverside — Riverside, CA
Research Assistant in Secure and Efficient Architectures and Systems (SEAS) Lab — 2021.9–Current
- Mentor: Prof. Nael B. Abu-Ghazaleh
- Topic: AR/VR Security, Computer Architecture Support for Security

Pacific Northwest National Laboratory — Richland, WA
Research Intern at the Center for Advanced Technology Evaluation (CENATE) — 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 — Riverside, CA
Graduate Student Mentor in UCR Graduate Student Mentorship Program (GMSP) — 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 — Irvine, CA
Teaching Assistant in Department of Electrical Engineering and Computer Science — 2018.9–2021.6
- Assisted course instructors in course website design, grading, and lecturing

Peer-reviewed Publications

Conference Papers

1. Carter Slocum, **Yicheng Zhang**, Jiasi Chen, Nael B. Abu-Ghazaleh, "Going through the motions: AR/VR keylogging from user head motions", *In Proceedings of the 32nd USENIX Security Symposium (**USENIX Security**), Anaheim, CA, USA, August, 2023.*

2. **Yicheng Zhang**, Carter Slocum, Jiasi Chen, 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 (*<u>**USENIX Security**</u>*), Anaheim, CA, USA, August, 2023.*

3. 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.*
   *Junyi Wei and Yicheng Zhang are both first author.

Journal Articles

1. **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 (**TIFS**), August, 2021.*

Posters

1. **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   Spring 2021
Organization of Digital Computers (EECS112)

Teaching Assistant at University of California, Irvine   Winter 2021
Next Generation Search Systems (CS125)

Teaching Assistant at University of California, Irvine   Fall 2020
Object Oriented System & Programming (EECS40)

Teaching Assistant at University of California, Irvine   Spring 2020
Sytem Software (EECS111)

Teaching Assistant at University of California, Irvine   Winter 2019
Continuous-Time Signals and Systems (EECS150)

Presentations and Talks

1. "It's all in your head(set): side-channel attacks on augmented reality systems" at USENIX Security'23, Anaheim, CA, USA, August, 2023

2. "Poster: Stealing Neural Network Structure through Remote FPGA Side-channel Analysis" at FPGA'21, virtual, February 2021

3. "Leaky DNN: Stealing Deep-Learning Model Secret with GPU Context-Switching Side-Channel" at DSN'20, virtual, June 2020

Skills

- **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

Professional Service

- Reviewer for Conference: ICPS' 20, CYBER' 21, CYBER' 22, ARES' 23, EAI SecureComm' 23
- Reviewer for Journal: JCS, IEEE TIFS, IEEE TC, IJACT, SCN, JSA
- Artifact Evaluation: Micro' 22

Research Projects

AR/VR typing inference using head motion tracking

- Developed a system, **TyPose**, that automatically infers words and characters typed by a user, including a Segmenter to divide a stream of sensor readings into the corresponding words/characters and a Classifier to infer the text corresponding to those segments.
- Collected user traces of AR/VR typing behavior and evaluated our attack on these traces. The results show that **TyPose** can detect segments and identify words with high accuracy.
- The related paper was accepted in Usenix Security 2023.

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

- Presented a taxonomy of the potential targets and leakage sources of software-based side-channel attacks on AR/VR devices and applications.
- Demonstrated five end-to-end side-channel attacks that illustrate three types of targets: Inferring (1) user interactions (hand gesture inputs, voice commands, and virtual keyboard inputs); (2) information about concurrent applications (fingerprinting newly launched applications); and (3) information about the environment (detecting and ranging a person in the environment).
- The related paper was accepted by Usenix Security 2023 (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.
- Used NearestNeighbors, GradientBoosting, DecisionTree, RandomForest, NeuralNetwork, NaiveBayes, AdaBoost, and XGB classifiers to recover hyper-parameters of victim model from side-channel signals.
- The related paper was accepted by FPGA 2021 and IEEE TIFS (First author).

Machine Learning 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 VGG16, ZFNET, AlexNet and MLP.
- The related paper was accepted by IEEE DSN 2020 (First author).

Academic Supervision and Mentorship

Undergraduate Students

- Clarity Shimoniak   UCR CSE, 2023–Current
- Cheng Gu   UCR CSE, 2022–Current
- Xuchang Zhan   UCI EECS, 2019-2020
- Kendus Tisdale-Jeffries   Alabama A&M, 2019 summer

Graduate Students

- Sriraksha Srirangapatna Arun   UCR CSE, 2023–Current
- Yuxin Qiu   UCR CSE, 2022–2023
- Ziyang Men   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**, 2023

Honors and Awards

- 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

- **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