

Shinan Liu

1ST YEAR PH.D. STUDENT IN COMPUTER SECURITY

Room 377, John Crerar Library, University of Chicago, Chicago, IL

✉ shinanliu@uchicago.edu | 🏠 www.shinan.info

“Becoming a hacker, poet and practical idealist.”

Education

University of Chicago

PH.D. STUDENT IN COMPUTER SCIENCE

- Advisors: Prof. Ben Y. Zhao and Prof. Heather Zheng

Illinois, USA

Sep. 2019 - PRESENT

University of Electronic Science and Technology of China

B.S. IN INFORMATION SECURITY@YINGCAI HONORS COLLEGE

- GPA 3.79/4.0; Rank 6/125; TOEFL 103(S25); GRE V152 Q170 AW3.5;
- Elected as a member of UESTC Network Security Innovation Program.

Sichuan, P.R. China

Sep. 2015 - June 2019

Experience

Secure Localization Team, Virginia Tech (Prof. Yaling Yang and Prof. Gang Wang)

LEADER

- Leading a group of 9 excellent researchers from Virginia Tech, Microsoft Research, Facebook and UESTC.
- Designing innovative methods for defending GPS spoofing attacks.

Blacksburg, USA

January 2019 - April 2019

NISL, Tsinghua University(Prof. Jianwei Zhuge and Pro. Haixin Duan)

RESEARCH ASSISTANT

- Designed a course in Wireless Security.
- Taught developers from China Mobile Wireless and mobile security at Huawei Hangzhou Research Center.

Beijing, P.R. China

April 2018 - August 2018

KnowWhy Co., Ltd.

FRONTEND INTERN DEVELOPER

- Implemented several web pages in a tech-stack of Slim/SCSS/CoffeeScript/Ruby on Rails/MongoDB, focusing on high-availability, fault tolerance, and auto-scaling.

Chengdu, P.R. China

Nov. 2017 - Jan. 2018

Microsoft Research Asia(Dr. Yuanchao Shu)

SHORT-TERM RESEARCH INTERN

- Designed and implemented a User Study focusing GPS spoofing attack in road navigation scenario. It consists of an interview, a questionnaire and a driving simulation.
- Developed a driving simulator based on Android and video game Euro Truck Simulator II. This system simulates the actual GPS spoofing attack in Budapest when using mobile navigators.
- Conducted the User Study on over 30 participants.

Beijing, P.R. China

Sep. 2017

Dominity Security Co., Ltd.

FOUNDER/CEO

- Found Dominity Security Co., Ltd. with 14 excellent peers and serve as CEO.
- Had an investment intention with Shanghai Newgen VC on 2 million yuan.
- Applied for 3 invention patents and got 2 utility patents, all of which were successfully documented.

Chengdu, P.R. China

Aug. 2017

Qihoo 360 Unicorn Team

SECURITY RESEARCH INTERN

- Researched on drone detection and anti-drone techniques.
- Implemented a drone detection system based on spectrum analysis using software-defined radio(SDR) and convolutional neural network(CNN).
- Open-sourced it on company website and got praises from team leader.

Beijing, P.R. China

July 2017 - Aug. 2017

Research

INTERESTS

My research interests lie widely in the area of wireless, mobile, embedded systems and security. I focus my eyes on wireless security threats in Internet of Things(IoT) and Cyber Physical Systems(CPS). Specifically, my research utilizes physical layer attacks to achieve application layer threats. I also design and implement attack and defense methods on navigation systems(such as GPS) using techniques like Software Defined Radio(SDR) and Deep Learning.

PROJECTS

GPS Stealthy Manipulation

Sichuan, P.R. China

SECURE LOCALIZATION TEAM(WORK WITH RESEARCHERS FROM VT,MSR AND FACEBOOK)

Nov. 2015 - PRESENT

- To divert mobiles to malicious locations, naive GPS spoofing attacks may never be practical. Therefore, we developed spoofing to stealthy manipulation. the goal of it is to use GPS spoofing techniques to trigger turn-by-turn navigation to guide the victim to a wrong destination without being noticed.
- Our key idea is to slightly shift the GPS location so that the fake navigation route matches the shape of the actual roads. By that means, we can trigger physically possible instructions that leads to dangerous places. We designed iterative attacking algorithm and measured the effects in physical environment and on actual users.

MAPRO & SecRF

Sichuan, P.R. China

DOMINITY SECURITY TECHNOLOGY CO., LTD.

Jan. 2017 - Oct. 2017

- We introduce MAPRO as a shield and filter to malicious GNSS spoofing signals. It's an embedded device which can be easily carried and settled beside valuable infrastructures.
- The key idea is to use SDR platforms to tranceive and process on GNSS signals(GPS, Beidou, GLONASS). Features are extracted and signals are categorized by a CNN model we trained. Then we use a technique called friendly spoofing to adjust physical signals to a normal state.
- We extend the frequency band to get more protections on other RF applications and then comes SecRF. MAPRO & SecRF are products we designed to secure GPS/RF-assisted devices in Dominity Security Technology Co., Ltd.

DeepDroneIndicator

Beijing, P.R. China

QIHOO 360 UNICORN TEAM

July 2017 - Aug. 2017

- Drones appearing in airport and private places are threatening, because those "flying laptops" disorder the aero-security and have capacity to get privacy without being noticed. Therefore, DeepDroneIndicator is a project focusing on detecting the flying directions of a drone.
- By monitoring the control loop(wireless channels) of a drone, its appearance and motions can get indicated. Further implementation involves localizing the drone and intelligently landing it by smart GPS and ADS-B spoofing.

TECHNICAL SKILLS

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|------------------------------------|--|
| Software Defined Radio | GNU Radio(HackRF, LimeSDR, USRP) |
| Machine & Deep Learning | Sk-Learn(SVM), Tensorflow(CNN, LSTM, etc.) |
| Programming Language | C, C++, Python, Java |
| Development Skill | Web(LAMP and Rails stacks), Android |

Publication

CONFERENCE

[C1] All Your GPS Are Belong To Us: Towards Stealthy Manipulation of Road Navigation Systems

Baltimore, MD, USA

KEXIONG (CURTIS) ZENG, SHINAN LIU, YUANCHAO SHU, DONG WANG, HAOYU LI, YANZHI DOU, GANG WANG AND YALING YANG. 27th USENIX Security Symposium(USENIX Security'18)

Aug. 15-17, 2018

WORKSHOP

[W1] A Practical GPS Location Spoofing Attack in Road Navigation Scenario

Sonoma, CA, USA

KEXIONG (CURTIS) ZENG, YUANCHAO SHU, SHINAN LIU, YANZHI DOU AND YALING YANG. 18th ACM Workshop on Mobile Computing Systems and Applications(Hotmobile'17)

Feb. 21-22, 2017

JOURNAL

[J1] Investigations on the local structures of Cu²⁺ at various BaO concentrations in 59B2O3-10K2O-(30x)ZnO-xBaO-1CuO glasses

London, UK

Jiarui JIN, Shaoyi Wu, Jian Hong, SHINAN LIU, Minxian Song, Baohua Teng, Minghe Wu. Philosophical Magazine, 97:31, 2858-2870

July 2017

POSTER

[Po1] Security Analysis of Multi-Sensor Fusion based Localization in Autonomous Vehicles

San Diego, CA, USA

JUNJIE SHEN, JUN YEON WON, SHINAN LIU, QI ALFRED CHEN, ALEXANDER VEIDENBAUM. Network & Distributed System Security Symposium NDSS'19 DISTINGUISHED POSTER PRESENTATION

Feb. 24-27, 2019

PATENT

[Pa1] A Wireless Signal Classification and Detection Method and Device

Chengdu, P.R.China

RUI KANG, SHINAN LIU, XIN ZHOU, HAO DU, XIBO YANG, SAI XU, SHENGZHI QIN, GAOXIANG WU. National Institution of Intellectual Property, P. R. China.

July, 2018

[Pa2] A Software-Defined Wireless Signal Reception Device and System

Chengdu, P.R.China

HAO DU, RUI KANG, GAOXIANG WU, SAI XU, SHINAN LIU, SHENGZHI QIN, XIBO YANG, XIN ZHOU. National Institution of Intellectual Property, P. R. China, ZL 2017 2 1090307.0

March, 2018

[Pa3] A Satellite Signal Classification and Detection Method and Device

SHENGZHI QIN, XIBO YANG, SAI XU, XIN ZHOU, RUI KANG, SHINAN LIU, GAOXIANG WU, HAO DU. *National Institution of Intellectual Property, P. R. China.*

Chengdu, P.R.China

Sep. 2017

[Pa4] A Software-Defined Satellite Signal Transceiving Device and System

GAOXIANG WU, HAO DU, SHENGZHI QIN, XIBO YANG, XIN ZHOU, RUI KANG, SAI XU, SHINAN LIU. *National Institution of Intellectual Property, P. R. China.*

Chengdu, P.R.China

Sep. 2017

[Pa5] A Secure Method and Device to Deliver Satellite Signal

SHINAN LIU, XIN ZHOU, XIBO YANG, RUI KANG, GAOXIANG WU, HAO DU, RUI KANG, SHENGZHI QIN, SAI XU. *National Institution of Intellectual Property, P. R. China.*

Chengdu, P.R.China

Sep. 2017

Honors & Awards

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|------|--|---------------------|
| 2019 | Best Undergrad Thesis , 1 out of 12 Students in UESTC | Sichuan, P.R.China |
| 2018 | Excellent Graduate of Sichuan Province , Top 1% Student of the University | Sichuan, P.R.China |
| 2018 | Network Security Scholarship , 1 of 66 Undergraduate Students Who Won this National Award | Beijing, P.R.China |
| 2017 | Highest Prize , 10th National University Students Information Security Competition | Xian, P.R.China |
| 2017 | National Third Prize & Provincial Golden Prize , 15th National Challenge Cup | Shanghai, P.R.China |
| 2017 | Golden Award , 3rd Internet+ Innovation Entrepreneurship Competition of Sichuan Province | Chengdu, P.R.China |
| 2017 | 4th Place , 1st Tianfu Cup Entrepreneurship Competition | Chengdu, P.R.China |
| 2017 | National Finalist , 2nd Innovation Competition at Yinchuan | Chengdu, P.R.China |
| 2017 | National Finalist , 2nd Head to Silicon Valley Entrepreneurship Competition | Shanghai, P.R.China |
| 2017 | 1st Place , Being a U-reader | Chengdu, P.R.China |
| 2016 | Silver Prize , National English Competition | Chengdu, P.R.China |
| 2016 | Leadership Award , G-MEO American University Summer Camp | Washington DC, USA |
| 2015 | Best Writer , UESTC radio station | Chengdu, P.R.China |
| 2015 | Several First Prizes , Competitions of presentation, reading and writing | Chengdu, P.R.China |

Activity

TECHNICAL TALK

A Practical GPS Location Spoofing Attack in Road Navigation Scenario@Turing Conference UESTC Div.

Chengdu, P.R. China

THE ONLY UNDERGRADUATE INVITEE

Feb., 2018

- Presented our work in front of professors and graduate students.

A security forum between academia and industry@XDef'17

Wuhan, P.R. China

THE ONLY UNDERGRADUATE INVITEE

Nov., 2017

- Gave suggestions on the education of university students who major in information security.

MAPRO: a GNSS protection system based on SDR and CNN @ XDef'17

Wuhan, P.R. China

STUDENT KEYNOTE SPEAKER

Nov., 2017

- Introduced the system design and implementation of MAPRO, emphasizing on current situations of GPS spoofing attacks.

Attack and Defense: A Systematic Review on Wireless Threats

Chengdu, P.R. China

STUDENT REPORTER OF UESTC NETWORK SECURITY INNOVATION PROGRAM

Oct., 2017

- Introduced a systematic review on threats and countermeasures faced by modern wireless networks.

DDI: Deep Learning in Drone Direction Indication

Beijing, P.R. China

INTERN RESEARCHER

Aug., 2017

- Introduced the system design and implementation of DDI.

TEACHING

Introduction to wireless security

Shanghai, P.R.China

INVITEE OF BLUEWHALECTF INC.

Aug. 12, 2018

- Taught general public the basics of wireless security in GSM/LTE networks and GPS security.

EXTERNAL REVIEWER

2017 **2 papers**, IEEE Conference on Computer Communications (INFOCOM)

Chengdu, P.R.China