

Lannan Lisa Luo



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RESEARCH INTERESTS

My research mainly focuses on **software and systems security**. My research interests include software analysis and verification, vulnerability discovery, malware analysis, and software engineering. I am also interested in applying deep learning for cybersecurity problems. My research approaches are mainly empirical in tandem with formal methods, combining symbolic execution, theorem proving, taint analysis, control flow analysis, and data flow analysis.

EDUCATION

Ph.D., Information Sciences and Technology, Penn State University	2012–2017
M.Sc., Communication and Information Systems, University of Electronic Science and Technology of China	2009–2012
B.S., Telecommunications Engineering, Xidian University, Xi'an, China	2005–2009

PROFESSIONAL EXPERIENCE

University of South Carolina, Assistant Professor	08/2017–present
Cyber Security Lab, Penn State University, Research Assistant	08/2012 – 05/2017
Microsoft Research Asia, Beijing, China, Research Intern	Summer 2015

PUBLICATIONS

(Names underlined are my supervised students.)

REFEREED JOURNAL PAPERS

- TMC'19 **Lannan Luo**, Qiang Zeng, Chen Cao, Kai Chen, Jian Liu, Limin Liu, Neng Gao, Min Yang, Xinyu Xing, and Peng Liu. “Tainting-Assisted and Context-Migrated Symbolic Execution of Android Framework for Vulnerability Discovery and Exploit Generation.” *IEEE Transactions on Mobile Computing (TMC)*, 2019.
- TDSC'19 Qiang Zeng, **Lannan Luo***, Zhiyun Qian, Xiaojiang Du, Zhoujun Li, Chin-Tser Huang, and Csilla Farkas (* Corresponding author). “Resilient User-Side Android Application Repackaging and Tampering Detection Using Cryptographically Obfuscated Logic Bombs.” *IEEE Transactions on Dependable and Secure Computing (TDSC)*, 2019.
- TSE'17 **Lannan Luo**, Jiang Ming, Dinghao Wu, Peng Liu, and Sencun Zhu. “Semantics-Based Obfuscation-Resilient Binary Code Similarity Comparison with Applications to Software and Algorithm Plagiarism Detection.” *IEEE Transactions on Software Engineering (TSE)*, 2017.

REFEREED CONFERENCE PAPERS

- ACSAC'21 **Lannan Luo**, Qiang Zeng, Bokai Yang, Fei Zuo, Junzhe Wang. “Westworld: Fuzzing-Assisted Remote Dynamic Symbolic Execution of Smart Apps on IoT Cloud Platforms.” In *Proceedings of the Annual Computer Security Applications Conference (ACSAC)*, 2021. [Acceptance rate = 24%]
- NDSS'21 Haotian Chi, Qiang Zeng, Xiaojiang Du, and **Lannan Luo**. “PFirewall: Semantics-Aware Customizable Data Flow Control for Home Automation Systems.” In *Proceedings of the 28th Annual Network and Distributed System Security Symposium (NDSS)*, 2021. [Acceptance rate = 15%]
- CCS'20 Xiaopeng Li, Qiang Zeng, **Lannan Luo**, and Tongbo Luo. “T2Pair: Secure and Usable Pairing for Heterogeneous IoT Devices.” In *Proceedings of the 27th ACM Conference on Computer and Communications Security (CCS)*, 2020. [Acceptance rate = 17%]
- SANER'20 **Lannan Luo**. “Heap Memory Snapshot Assisted Program Analysis for Android Permission Specification.” In *Proceedings of the 27th IEEE International Conference on Software Analysis, Evolution and Reengineering (SANER)*, 2020. [Acceptance rate = 23%]
- MobiCom'19 Xiaopeng Li, Fengyao Yan, Fei Zuo, Qiang Zeng, and **Lannan Luo**. “Touch Well Before Use: Intuitive and Secure Authentication for IoT Device.” In *Proceedings of the 25th Annual International Conference on Mobile Computing and Networking (MobiCom)*, 2019. [Acceptance rate = 16% (the winter round)]
- NDSS'19 Fei Zuo, Xiaopeng Li, Patrick Young, **Lannan Luo**, Qiang Zeng, and Zhexin Zhang. “Neural Machine Translation Inspired Binary Code Similarity Comparison beyond Function Pairs.” In *Proceedings of the 26th Network and Distributed System Security Symposium (NDSS)*, 2019. [Acceptance rate = 17%]
- RAID'19 Fei Zuo, Bokai Yang, Xiaopeng Li, **Lannan Luo**, and Qiang Zeng. “Exploiting the Inherent Limitation of L_0 Adversarial Examples.” In *Proceedings of the 22nd International Symposium on Research in Attacks, Intrusions and Defenses (RAID)*, 2019. [Acceptance rate = 22%]
- DSN'19 Qiang Zeng, Jianhai Su, Chenglong Fu, Golam Kayas, **Lannan Luo**, Xiaojiang Du, Chiu Tan, and Jie Wu. “A Multiversion Programming Inspired Approach to Detecting Audio Adversarial Examples.” In *Proceedings of the 49th IEEE/IFIP International Conference on Dependable Systems and Networks (DSN)*, 2019. [Acceptance rate = 21%]
- DSN'19 Qiang Zeng, Golam Kayas, Emil Mohammed, **Lannan Luo**, Xiaojiang Du, and Junghwan Rhee. “HeapTherapy+: Efficient Handling of (Almost) All Heap Vulnerabilities Using Targeted Calling-Context Encoding.” In *Proceedings of the 49th IEEE/IFIP International Conference on Dependable Systems and Networks (DSN)*, 2019. [Acceptance rate = 21%]
- CGO'18 Qiang Zeng, **Lannan Luo**, Zhiyun Qian, Xiaojiang Du, and Zhoujun Li. “Resilient Decentralized Android Application Repackaging Detection Using Logic Bombs.” In *Proceedings of IEEE/ACM International Symposium on Code Generation and Optimization (CGO)*, 2018. [Acceptance rate = 29%]
- MobiSys'17 **Lannan Luo**,* Qiang Zeng,* Chen Cao, Kai Chen, Jian Liu, Limin Liu, Neng Gao, Min Yang, Xinyu Xing, and Peng Liu (*co-first authors). “System Service Call-oriented Symbolic Execution of Android Framework with Applications to Vulnerability Discovery and Exploit Generation.” In *Proceedings of the 15th ACM International Conference on Mobile Systems, Applications, and Services (MobiSys)*, 2017. [Acceptance rate = 18%]
- DSN'16 **Lannan Luo**, Yu Fu, Dinghao Wu, Sencun Zhu, and Peng Liu. “Repackage-proofing Android Apps.” In *Proceedings of the 46th Annual IEEE/IFIP International Conference on Dependable Systems and Networks (DSN)*, 2016. [Acceptance rate = 22%]
- ICSE-SEET'16 **Lannan Luo** and Qiang Zeng. “SolMiner: Mining Distinct Solutions in Programs.” In *Proceedings of the 38th International Conference on Software Engineering (ICSE), SEET track*, 2016. [Acceptance rate = 34%]

FSE'14 **Lannan Luo**, Jiang Ming, Dinghao Wu, Peng Liu, and Sencun Zhu. “Semantics-Based Obfuscation-Resilient Binary Code Similarity Comparison with Applications to Software Plagiarism Detection.” In *Proceedings of the 22nd ACM SIGSOFT International Symposium on the Foundations of Software Engineering (FSE)*, 2014. **Best Paper Award Nomination**. [Acceptance rate = 22%]

REFEREED WORKSHOP PAPERS

BAR'19 Kimberly Redmond, **Lannan Luo**, and Qiang Zeng. “A Cross-Architecture Instruction Embedding Model for Natural Language Processing-Inspired Binary Code Analysis.” In *Proceedings of the NDSS Workshop on Binary Analysis Research (BAR)*, 2019.

AICS'19 Qiang Zeng, Jianhai Su, Chenglong Fu, Golam Kayas, and **Lannan Luo**. “A Multiversion Programming Inspired Approach to Detecting Audio Adversarial Examples.” In *the AAAI Workshop on Artificial Intelligence for Cyber Security (AICS)*, 2019.

ASCE'13 Nan Yu, Yufei Jiang, **Lannan Luo**, Sanghoon Lee, Abdou Jallow, Dinghao Wu, John Messner, Robert Leicht, and John Yen. “Integrating BIMserver and OpenStudio for Energy Efficient Building.” In *Proceedings of the 2013 ASCE International Workshop on Computing in Civil Engineering (ASCE)*, 2013.

TECHNICAL REPORT

arXiv Gautham Ramajayam, Tao Sun, Chiu C. Tan, **Lannan Luo**, Haibin Ling. “Deep Learning Approach Protecting Privacy in Camera-Based Critical Applications.” arXiv preprint arXiv:2110.01676, 2021.

Tech Report Ravshanbek Norboev, Zakia Hossain, Qiang Zeng, and **Lannan Luo**. “On the Robustness of Stochastic Stealthy Network against Android App Repackaging.” Technical Report, 2017.

GRANTS

- NSF CNS-1953073, “SaTC: CORE: Small: Semantics-Oriented Binary Code Analysis Learning from Recent Advances in Deep Learning,” PI, \$416,947, 2020-2023.
- NSF CNS-1850278, “CRII: SaTC: A Malware-Inspired Approach to Mobile Application Repackaging and Tampering Detection,” PI, \$174,879, 2019-2022.
- NSF CNS-1815144, “SaTC: CORE: Small: Collaborative: Enabling Precise and Automated Insecurity Analysis of Middleware on Mobile Platforms,” PI, total: \$491,161, my share: \$159,000, 2018-2021.
- USC ASPIRE-I, “Vulnerability Discovery and Test Input Generation for Android System Services,” PI, \$14,994, 2018-2019.

SOFTWARE RELEASE

- Code and datasets for WESTWORLD (ACSAC'21) are publicly available at <https://github.com/lannan/Westworld>.
- Code, datasets, and models for INNEREYE (NDSS'19) are publicly available at <https://nmt4binaries.github.io>.
- Code, datasets, and models for AEPECKER (RAID'19) are publicly available at <https://github.com/fzuo/AEPecker>.
- Code, datasets, and models for MVP-EARS (DSN'19) are publicly available at <https://github.com/quz105/MVP-audio-AE-detector>
- Code, datasets, and models for CAIE (BAR'19) are publicly available at <https://github.com/nlp-code-analysis/cross-arch-instr-model>.
- Code for CENTAUR (MobiSys'17) is publicly available at <https://github.com/Android-Framework-Symbolic-Executor/Centaur>.

ACADEMIC SERVICE

- NSF Review Panelist, 2019, 2021
- TPC member for NDSS, 2021, 2022
- TPC member for ACSAC, 2019, 2020, 2021
- TPC member for DSN, 2022
- TPC member for AsiaCCS, 2020, 2021, 2022
- TPC member for GLOBECOM, 2020
- TPC member for IEEE International Conference on Mobile Ad hoc and Sensor Systems (MASS), 2018, 2019, 2021
- TPC member for IEEE International Conference on Multimedia and Expo (ICME), 2019
- Workshops Chair for EAI International Conference on Security and Privacy in Communication Networks (SecureComm), 2022
- Judge for the ICSE Student Research Competition, 2020.
- Publicity Co-Chair for IEEE Conference on Communications and Network Security (CNS), 2018
- Reviewer for IEEE Transactions on Software Engineering (TSE)
- Reviewer for IEEE Transactions on Information Forensics & Security (T-IFS)
- Reviewer for IEEE Transactions on Reliability (TR)
- Reviewer for Cybersecurity
- Reviewer for IEEE Access
- Reviewer for ACM Transactions on Internet Technology (TOIT)
- Reviewer for ACM Transactions on Privacy and Security (TOPS)
- Reviewer for IEEE Security & Privacy
- Reviewer for Empirical Software Engineering (EMSE)
- Reviewer for IEEE Transactions on Cluster Computing
- Reviewer for IEEE Transactions on Services Computing

DEPARTMENTAL & UNIVERSITY SERVICE

- Graduate Committee in the CSE department at UofSC, 2017–Present
- Faculty Search Committee in the CSE department at UofSC, 2019
- Faculty Senator at UofSC, 2019
- Reviewer for the Research Initiative for Summer Engagement (RISE) program at UofSC, 2019
- Panel Member for the Cybersecurity Symposium hosted by Benedict College, Columbia, 2017
- Faculty Member for the Grace Hopper Celebration of Women in Computing (GHC), 2018, 2019, 2020, 2021.

AWARDS/HONORS

- The 2020 Young Investigator Research Award in College of Engineering and Computing at UofSC
- Best Paper Award Nomination in ACM SIGSOFT/FSE 2014
- Multiple Conference Travel Grants, 2014-2016
- Top-class Scholarship with Honor, UESTC, 2010–2012
- Excellent Graduate Student, UESTC, 2010–2012
- Top-class Scholarship with Honor, Xidian University, 2006–2009
- Excellent Student, Xidian University, 2006–2009
- First Prize in the Mathematical Modeling Contest of Shaanxi, 2007

TEACHING

Instructor at University of South Carolina:

- Fall 2021, *CSCE 201: Introduction to Computer Security*, Undergraduate, Instructor
Student enrollment: 46
Student feedback: overall instructor: TBD
- Spring 2021, *CSCE 548: Building Secure Software*, Graduate and Undergraduate, Instructor
Student enrollment: 45
Student feedback: overall instructor: 4.67/5
- Fall 2020, *CSCE 790: Introduction to Software Analysis*, Graduate, Instructor
Student enrollment: 14
Student feedback: 4.91/5
- Fall 2019, *CSCE 813: Internet Security*, Graduate, Instructor
Student enrollment: 14
Student feedback: 4.82/5
- Spring 2019, *CSCE 201: Introduction to Computer Security*, Undergraduate, Instructor
Student enrollment: 41
Student feedback: overall instructor 4.14/5
- Spring 2019, *CSCE 791: Seminar in Advances in Computing*, Graduate, Instructor
Student enrollment: 17
Student feedback: overall instructor 4.4/5
- Fall 2018, *CSCE 790: Introduction to Software Analysis*, Graduate, Instructor
Student enrollment: 20
Student feedback: overall instructor 4.72/5
- Spring 2018, *CSCE 548: Building Secure Software*, Graduate and Undergraduate, Instructor
Student enrollment: 45
Student feedback: overall instructor 4.77/5
- Fall 2017, *CSCE 813: Internet Security*, Graduate, Instructor
Student enrollment: 13
Student feedback: overall instructor 4.83/5

Teaching Assistant at Penn State University:

- Fall 2015, *IST 451: Network Security*, Teaching Assistant.
- Spring 2015, *IST 220: Networking and Telecommunications*, Teaching Assistant
- Fall 2014, *IST 451: Network Security*, Teaching Assistant
- Spring 2014, *IST 451: Network Security*, Teaching Assistant

MENTORSHIP/STUDENT SUPERVISION

Current Students

PhD Students:

- Matthew Sharp (Fall 2020–present)
- Junzhe Wang (Fall 2020–present; co-advised)
- Iftakhar Ahmad (Spring 2021–present)
- Xiaoyue Ma (Fall 2021–present)

Master Students:

- Alex Scott (Fall 2021–present)

Graduated Students

PhD Students:

- Xiaopeng Li (Spring 2018–Spring 2020; co-advised) Now: Applied & Data Scientist, Microsoft.

Master Students:

- Fengyao Yan (Fall 2017–Spring 2019) Continued PhD study at UofSC.
- Kimberly Redmond (Spring 2018–Spring 2019) Now: Software Engineer, Motorola Solutions, Inc.

Undergraduate Students:

- Jason Abraham (Fall 2017–Spring 2019)
- Franco Godoy (Spring 2018)
- Steven Maxwell (Spring 2019)
- Andrew Cox (Spring 2019)