Xiaolu Hou

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EDUCATION

Ph. D. in Mathematical Sciences   Jan 2013 – May 2017
Nanyang Technological University(NTU), Singapore   CGPA: 5.00/5.00
Thesis title: Algebraic Constructions of Modular Lattices
Advisor: Assoc Prof. Frédérique Oggier

B. S. in Mathematical Sciences, specialization in pure mathematics   Aug 2009 – Jan 2012
NTU, Singapore   First-Class Honor with CGPA 4.96/5.00

EXPERIENCE

Assistant Professor at Faculty of Informatics and Information Technologies (FIIT), Slovak University of Technology (STU)   Mar 2021 – Present

- Research in hardware security and cryptography
- Research in AI security

Research Scientist at Physical Analysis & Cryptographic Engineering Lab, NTU   Jan 2020 – Dec 2020

- Analyzing side-channel and fault vulnerabilities of cryptographic implementations in software and hardware.
- Exploring usage of onboard analog-to-digital converters for side-channel leakage.
- Developing countermeasures against physical attacks.
- Evaluating neural network security w.r.t. fault attacks.

Research Fellow at National University of Singapore   Jul 2019 – Jan 2020

- Hardware security – countermeasures against fault attacks.
- Differential privacy of deep neural networks.

Secure Computing Researcher at Acronis   Nov 2018 – Jul 2019

- Research and development focusing on secure multiparty computation – threat analysis and prototype implementation.
- Development of methods and tools for secure synthetic data generation.

Research Fellow at Cyber Security Lab, NTU   Aug 2017 – Nov 2018

- Security of deep neural networks – analyzing vulnerabilities of activation functions in neural networks w.r.t. fault attacks.
- Fault injection and side-channel attacks on cryptographic implementations and countermeasures.

Researcher at Singapore University of Technology and Design (SUTD)   Feb 2017 – Aug 2017

Research Fellow (May 2017 – Aug 2017)
Research Assistant (Feb 2017 – May 2017)

- Hardware security – developing software based countermeasures against fault attacks.
- Location privacy – estimating the effort of an attacker for locating a victim utilizing applications on a mobile device.

PUBLICATIONS

Book:

1. *Automated Methods in Cryptographic Fault Analysis*, Jakub Breier, Xiaolu Hou and Shivam Bhasin (Eds.), ISBN: 978-3-030-11332-2, Springer, 2019.

Book Chapter:

1. *On Implementation-Level Security of Edge-Based Machine Learning Models*, Lejla Batina, Shivam Bhasin, Jakub Breier, Xiaolu Hou, Dirmanto Jap, Security and Artificial Intelligence: A Crossdisciplinary Approach, Springer Nature, 2022.

Journal:

J1. *FooBaR: Fault Fooling Backdoor Attack on Neural Network Training*, Jakub Breier, Xiaolu Hou, Martín Ochoa, Jesus Solano, IEEE Transactions on Dependable and Secure Computing (TDSC), to appear.

J2. *SNIFF: reverse engineering of neural networks with fault attacks*, Jakub Breier, Dirmanto Jap, Xiaolu Hou, Shivam Bhasin, Yang Liu, IEEE Transactions on Reliability, to appear.

J3. *Constrained Proximity Attacks on Mobile Targets*, Xueou Wang, Xiaolu Hou, Ruben Rios, Nils Ole Tippenhauer, Martín Ochoa, ACM Transactions on Privacy and Security, no. 2, 2022.

J4. *A Finer-Grain Analysis of the Leakage (Non) Resilience of OCB*, Francesco Berti, Shivam Bhasin, Jakub Breier, Xiaolu Hou, Romain Poussier, François-Xavier Standaert, Balazs Udvarhelyi, IACR Transactions on Cryptographic Hardware and Embedded Systems (TCHES), no. 1, 2022.

J5. *Back To The Basics: Seamless Integration of Side-Channel Pre-processing in Deep Neural Networks*, Yoo-Seung Won, Xiaolu Hou, Dirmanto Jap, Jakub Breier, Shivam Bhasin, IEEE Transactions on Information Forensics and Security (TIFS), 2021.

J6. *Physical Security of Deep Learning on Edge Devices: Comprehensive Evaluation of Fault Injection Attack Vectors*, Xiaolu Hou, Jakub Breier, Dirmanto Jap, Lei Ma, Shivam Bhasin, Yang Liu, Microelectronics Reliability, Elsevier, 2021.

J7. *On Evaluating Fault Resilient Encoding Schemes in Software*, Jakub Breier, Xiaolu Hou and Yang Liu, IEEE Transactions on Dependable and Secure Computing (TDSC), no. 3, 2021.

J8. *A Countermeasure Against Statistical Ineffective Fault Analysis*, Jakub Breier, Mustafa Khairallah, Xiaolu Hou, Yang Liu, IEEE Transactions on Circuits and Systems–II, no. 12, 2020.

J9. *SITM: See-In-The-Middle–Side-Channel Assisted Middle Round Differential Cryptanalysis on SPN Block Ciphers*, Shivam Bhasin, Jakub Breier, Xiaolu Hou, Dirmanto Jap, Romain Poussier, Siang Meng Sim, IACR Transactions on Cryptographic Hardware and Embedded Systems (TCHES), no. 1, 2020.

J10. *On Side Channel Vulnerabilities of Bit Permutations in Cryptographic Algorithms*, Jakub Breier, Dirmanto Jap, Xiaolu Hou and Shivam Bhasin, IEEE Transactions on Information Forensics and Security (TIFS), 2020.

J11. *Fully Automated Differential Fault Analysis on Software Implementations of Block Ciphers*, Xiaolu Hou, Jakub Breier, Fuyuan Zhang and Yang Liu, IACR Transactions on Cryptographic Hardware and Embedded Systems (TCHES), no. 3, 2019.

J12. *Fault Attacks Made Easy: Differential Fault Analysis Automation on Assembly Code*, Jakub Breier, Xiaolu Hou and Yang Liu, IACR Transactions on Cryptographic Hardware and Embedded Systems (TCHES), no. 2, 2018.

J13. *Modular Lattices from a Variation of Construction A over Number Fields*, Xiaolu Hou and Frédérique Oggier, Advances in Mathematics of Communications, no. 4, 2017.

J14. *Construction of Arakelov-modular Lattices over Totally Definite Quaternion Algebras*, Xiaolu Hou, International Journal of Number Theory, no. 7, 2017.

J15. *Hilbert spaces of entire Dirichlet series and composition operators*, Xiaolu Hou, Le Hai Khoi and Bingyang Hu, Journal of Mathematical Analysis and Applications, no. 1, 2013.

J16. *Composition operators on Hilbert spaces of entire Dirichlet series*, Xiaolu Hou, Le Hai Khoi and Bingyang Hu, Comptes Rendus Mathematique, no. 19–20, 2012.

J17. *Some properties of composition operators on entire Dirichlet series with real frequencies*, Xiaolu Hou and Le Hai Khoi, Comptes Rendus Mathematique, no. 3–4, 2012.

Conference Proceedings:

C1. *DNFA: Differential No-Fault Analysis of Bit Permutation Based Ciphers Assisted by Side-Channel*, Xiaolu Hou, Jakub Breier and Shivam Bhasin, IEEE Design, Automation and Test in Europe Conference (DATE 2021), France.

C2. *Security Evaluation of Deep Neural Network Resistance Against Laser Fault Injection*, Xiaolu Hou, Jakub Breier, Dirmanto Jap, Lei Ma, Shivam Bhasin and Yang Liu, IEEE International Symposium on the Physical and Failure Analysis of Integrated Circuits (IPFA 2020), Singapore.

C3. *SoK: On DFA Vulnerabilities of Substitution-Permutation Networks*, Mustafa Khairallah, Xiaolu Hou, Zakaria Najm, Jakub Breier, Shivam Bhasin, Thomas Peyrin, ACM SIGSAC Asia Conference on Computer & Communications Security (AsiaCCS) 2019, Auckland, New Zealand.

C4. *Poster: Practical Fault Attack on Deep Neural Networks*, Jakub Breier, Xiaolu Hou, Dirmanto Jap, Lei Ma, Shivam Bhasin and Yang Liu, ACM SIGSAC Conference on Computer and Communications Security (CCS) 2018, Toronto, Canada.

C5. *Location Proximity Attacks against Mobile Targets: Analytical Bounds and Attacker Strategies*, Xueou Wang, Xiaolu Hou, Ruben Rios, Per Hallgren, Nils Tippenhauer and Martin Ochoa, European Symposium on Research in Computer Security (ESORICS) 2018, Barcelona, Spain.

C6. *Feeding two cats with one bowl: On designing a fault and side-channel resistant software encoding scheme*, Jakub Breier, and Xiaolu Hou, Cryptographers' Track at the RSA Conference (CT-RSA) 2017, San Francisco, US.

C7. *On LCD Codes and Lattices*, Xiaolu Hou, and Frédérique Oggier, IEEE International Symposium on Information Theory (ISIT) 2016, Barcelona, Spain.

C8. *Construction and Secrecy Gain of a Family of 5-modular Lattices*, Xiaolu Hou, Fuchun Lin and Frédérique Oggier, IEEE Information Theory Workshop 2014, Hobart, Tasmania, Australia.

GRANTS

- *Implementation Security of Neural Networks*, project of the Slovak Research and Development Agency, SK-SRB-21-0059, 2022 - 2023, principal investigator.
- *Hardware Security of Neural Networks*, SASPRO-2 Grant, European Union's Horizon 2020 research and innovation programme, Marie Skłodowska-Curie funding scheme No. 945478, 2021 - 2024, main recipient.

PROGRAM COMMITTEE MEMBER

- IACR Cryptographic Hardware and Embedded Systems Conference (CHES) 2021, 2022, 2023.
- IFIP/IEEE International Conference on Very Large Scale Integration (VLSI-SoC) 2021, 2022.
- 27th Australasian Conference on Information Security and Privacy (ACISP) 2022.
- 3rd workshop on Artificial Intelligence in Hardware Security (AIHWS) 2022.
- Informatics and Information Technologies Student Research Conference (IIT.SRC) 2021, 2022.
- IEEE International Conference on High Performance Computing and Communications (HPCC) 2020, 2021, 2022.

OTHER SCIENTIFIC AND SOCIETAL IMPACT

- Guest editor for special issue on Fault Analysis in Cryptography in Cryptography journal, MDPI, 2022.
- Session chair for IACR Cryptographic Hardware and Embedded Systems Conference (CHES) 2020, 2021.
- Member of organization team for International Workshop on Constructive Side-Channel Analysis and Secure Design (Cosade) 2018.
- Judge for Singapore International Mathematics Challenge 2014.
- Reviewer for international scientific journals.

HONORS AND AWARDS

- *Presidential award for female scientist*, Slovak University of Technology, 2021.
- *Nanyang President's Graduate Scholarship*, a competitive and prestigious scholarship scheme for outstanding graduate. 2013 - 2017.
- *Lee Kuan Yew Gold Medal*, the most prestigious award at NTU, given to the top student in each degree program of the graduating cohort who has excelled in general proficiency and has obtained the First Class Honors. 2012.
- *Dean's list*, for the top 5% of the cohort every academic year. 2009 - 2010, 2010 - 2011, 2011 - 2012.
- *NTU President Research Scholar* and participated in URECA, which is by invitation only to the most academically able second and third year undergraduate. 2010 - 2011.
- *SM2 Scholarship* for undergraduate studies at NTU through a selection with exams and interview. 2009 - 2012.

TEACHING EXPERIENCE

Teaching Assistant at NTU, Singapore:

- *Discrete Mathematics*, an introductory course of discrete mathematics for first year mathematics students, Jan - May 2016 and Jan - May 2015

- *Group and Symmetries*, an introductory course of abstract algebra for second year mathematics students, Aug - Dec 2015

- *Discrete Mathematics for Engineering School*, an introductory course of discrete mathematics for first year computer science and computer engineering students, Aug - Dec 2014

- *Engineering Math*, an introductory course of linear algebra and calculus for first year engineering students, Aug - Dec 2012

INVITED TALKS

- *Artificial Intelligence-Assisted Side Channel Attacks*, Keynote speaker, The 2nd International Workshop on Security and Privacy in Intelligent Infrastructures, in conjunction with the 17th International Conference on Availability, Reliability and Security, Aug 2022.

- *Reverse Engineering of Neural Networks with Fault Attacks*, AICrypt workshop, collocated with Eurocrypt 2021, Zagreb, Croatia, 16th Oct 2021.

- *AI for Physical Attacks and Physical Attacks on AI*, Advances in Applied Mathematical Sciences Webinar, Department of Mathematics and Statistics, Newman College, Thodupuzha (affiliated to M G University, Kottayam), Kerala, India, 23rd Sep 2021.

- *Side-Channel Attacks*, Information security seminar at FIIT STU, Bratislava, Slovakia, 11th Jun 2021.

- *On Side Channel and Fault Attacks against Machine Learning*, Virtual Workshop on Machine Learning & Hardware Security, 26th August 2020.

- *Side-Channel Analysis for Reverse Engineering of Secret Cipher*, Targeted Training on Advanced Side Channel Evaluation of Hardware Security (ASCEHS), IIT Kharagpur, India, 4th July 2018.

- *Construction of Modular Lattices from Linear Codes and Number Fields*, Computational & Statistical Sciences (MCSS) Seminar, Yale-NUS, Singapore, 26th Sep 2016.

SKILLS

Programming Languages

- Java (*Advanced*)
- Python (*Advanced*)
- AVR Assembly (*Intermediate*)
- C++ (*Intermediate*)

Other Skills

- Fault analysis
- Side-channel Analysis
- Cryptology
- Coding Theory
- Machine Learning and AI

Language

- English (*Fluent*)
- Mandarin (*Native*)