Chen Wang

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EDUCATION

- **Ph.D. Candidate in Computer Engineering** September 2017 - Present
  ECE Department & WINLAB, Rutgers University, New Brunswick, NJ
  Advisor: Prof. Yingying Chen
- **Ph.D. Candidate in Computer Engineering** August 2013 - August 2017
  Stevens Institute of Technology, Hoboken, NJ
  Advisor: Prof. Yingying Chen
- **M.S. in Electrical and Communication Engineering** August 2009 - July 2012
  University of Electronic Science & Technology of China, Chengdu, China
  Advisor: Prof. Liang Zhou
- **B.S. in Communication Engineering** August 2005 - July 2009
  University of Electronic Science & Technology of China, Chengdu, China

RESEARCH INTERESTS

Cyber Security and Privacy, Smart Healthcare, Mobile Sensing and Computing, Internet of Things, Machine Learning, Cyber-human Systems, Wireless Communications

HONORS AND AWARDS

- **Best Paper Award** in the IEEE Conference on Communications and Network Security (IEEE CNS), 2018. - First author
- **Best Paper Award** at ACM Symposium on Information, Computer and Communications Security (ACM ASIACCS), 2016. - First author
- **Best Paper Award** at IEEE Conference on Communications and Network Security (IEEE CNS), 2014. - Second author
- **Best Poster Award Runner-up** at ACM Conference on Mobile Computing and Networking (ACM MobiCom), 2018. – First author
- **First Place Winner -** IEEE North Jersey Cybersecurity Poster Award at 4th Annual Symposium on Cybersecurity & Internet of Things, 2016. – First author
- **ECE Outstanding Research Assistant Award** at Stevens Institute of Technology, 2016.
- **Student Travel Grants** from MobiCom 2018 SRC, CNS 2018, ICDCS 2017, Stevens Graduate Conference Fund 2017 and CNS 2014.
- **Third Place in Poster Competition** at IEEE North Jersey Advanced Communications Symposium, 2015.
- **University Excellence Scholarship** for graduate students, UESTC, 2009-2012.
- **University Excellence Scholarship** for undergraduate students, UESTC, 2007.
- **Graduate Student Soccer Champion**, UESTC, 2010.
- **Outstanding Volunteer in 2008 Sichuan Earthquake**, China, 2008

MEDIA COVERAGE

- Our work **"Towards In-baggage Suspicious Object Detection Using Commodity WiFi"** was reported by CBS TV, BBC News, NBC New York, IEEE Engineering 360, Philadelphia Inquirer, Science Daily, Yahoo News and over 50 other media outlets, July 2018. – First author
- Our work **"Finger-input Authentication via Physical Vibration"** was reported by Rutgers News, IEEE Spectrum, NSF Science 360 News, Yahoo Finance, Science Daily, CBC Radio, Economic Times, R&D Magazine, IEEE's Electronics 360 and 30 other media outlets, October 2017. – Second author
- Our work **"Friend or Foe? Your Wearable Devices Reveal Your Personal PIN"** was reported by Stevens News, IEEE Spectrum, CNN, NSF, ABC news, Yahoo Tech, Fortune, PHYS ORG, Daily Mail and 60 other media outlets, July 2016. – First author
- Our work **"Sleep Monitoring Using Smartphones"** was reported by MIT Technology Review news, Yahoo News, Zeenews and VOA-TV, December 2014. – Second author

RESEARCH EXPERIENCE

Wireless Information Network Laboratory (WINLAB), Rutgers University

09/2017 – 05/2019

- **Wearable-Assisted Cross-Domain Authentication to Voice Assistants**
  - Researched on the security issues of the emerging voice assistant (VA) systems and developed a cross-domain approach (i.e., audio- and vibration-domain) to defend against the various acoustic attacks (e.g., impersonation, replay and hidden command attacks).
  - Proposed to use an off-the-shelf wearable device (e.g., a smartwatch or bracelet) as a secure token to verify the user's voice commands to the VA system.
  - Compared the voice assistant device's microphone data and the wearable device's motion sensor data in response to the user's voice command to verify whether the command comes from the legitimate user and not from an imposter.

- **Inferring Mobile Payment Passcodes Leveraging Wearable Devices**
  - Explored to what extent the user's mobile payment PIN/pattern could be revealed from a wearable device under various hand-input ways involving two hands or a single hand.
  - Developed the training-free Euclidean distance-based model and the parallel PIN inference algorithms to infer the PIN entries in the two-hand scenarios and the learning-based methods to infer PIN entries in the single-hand scenarios.

- **Towards In-baggage Suspicious Object Detection Using Commodity WiFi**
  - Proposed to utilize the fine-grained channel state information (CSI) from off-the-shelf WiFi to detect suspicious objects that are suspected to be dangerous (i.e., defined as any metal and liquid object) without penetrating the user's privacy.
  - Developed a system that can detect the existence of suspicious objects, identify the dangerous material type and further determine the risk level of the object by examining the object's dimension (i.e., liquid volume and metal object's shape) based on analyzing the CSI of the WiFi signals.

- **Finger-input Authentication on Ubiquitous Surfaces via Physical Vibration**
  - Researched on extending finger-input authentication beyond touch screens to any solid surface and integrating password, behavioral and physiological characteristics, and surface dependency together to provide enhanced security.
  - Developed the first vibration-signal-based finger-input authentication system available to be deployed on any surface with only a pair of low-cost vibrator and vibration receiver.

Data Analysis and Information Security Laboratory (DAISY),

Stevens Institute of Technology **08/2013 – 08/2017**

- **Exploring the PIN sequence leakage from wearable devices**

- Explored the possibility of using embedded sensors in wearable devices, i.e., accelerometers, gyroscopes, and magnetometers, to derive the moving distance of the user's hand during accessing to key-based security systems.
- Showed that a wearable device can be exploited to discriminate mm-level distances and directions of the user's fine-grained hand movements, which enable attackers to reproduce the trajectories of the user's hand and further to recover the secret key entries.
- Designed Backward PIN-Sequence Inference algorithm exploits the inherent physical constraints between key entries to infer the complete user key entry sequence.

- **Fine-grained Sleep Monitoring**
  - Researched on a fine-grained sleep monitoring system which is capable of detecting the breathing rate by leveraging smartphones.
  - Leveraged the readily available smartphone earphone to reliably capture the human breathing sound during sleep.
  - Further monitored detailed sleep events including snore, cough, turn over and get up based on the acoustic features extracted from the acoustic sound and machine learning-based methods.

- **Real-time E-Signature for Securing Mobile Transactions**
  - Proposed a critical segment based online signature verification system to secure mobile transactions on multi-touch mobile devices.
  - Identified and exploited the segments which remain invariant within a user's signature to capture the intrinsic signing behavior embedded in each user's signature.
  - Further extracted distinguishable features from a user's signature that describe both the geometric layout of the signature and the unique physiological characteristics of the user's signing behavior for user verification.

- **Rogue Access Point Localization Leveraging Channel Information**
  - Proposed to localize the rogue Access Point (AP) using the Channel State Information from commercial Wi-Fi devices to secure the Wi-Fi network.
  - Extracted both the amplitude and phase features from the 30 subcarriers of the Channel State Information to determine the direction of the rogue AP and further leverage the special diversity to localize the rogue AP.

National Key Lab of Sci & Tech on Communications (NKLSTC), UESTC, China

09/2009 - 07/2012

- **Parallel decoding algorithms for Convolutional Turbo Code (CTC)**
  - Researched on the enhancement of iterative decoding algorithm of CTC and the computation complexity reduction.
  - Proposed three novel parallel decoding algorithms based on Log-MAP and further combined the three parallel algorithms together to form a three-dimension parallel decoding algorithm.

- **Simulation and verification of IEEE802.16m**
  - Set up the Link-Layer simulation module of IEEE 802.16m and realized Hybrid Automatic Repeat Request using CTC as its Forward Error Correction Code.
  - Compared the Turbo code types in 802.16m and in LTE-Advanced and evaluate their performance.

TEACHING EXPERIENCE

Graduate Courses

- 16:332:563 Computer Architecture, Rutgers University **Fall 2018**
  - Taught the lecture Introduction of Simple Scalar Simulation Tool
  - Prepared the computer architecture projects including simulating cache, branch prediction and pipeline under various configurations
  - Homework/exam/course project grading

- 16:332:519 Information and Network Security, Rutgers University **Spring 2018**
  - Taught the special topic of the security issues on mobile devices and wireless devices
  - Taught C programing and Python for building crypto systems
  - Homework/exam/course project grading
- 16:332:579 Computing Principles for Mobile Embedded Sys, Rutgers University **Fall 2017**
  - Prepared embedded system projects on Android systems and Pip tags
  - Homework/exam/course project grading

Undergraduate Courses

- 14:332:456 Network Centric Programming, Rutgers University **Spring 2018**
  - Contributed to the preparation of the lecture materials
  - Developed course projects and homework
  - Homework/exam/course project grading
- 14:332:437 Digital System Design, Rutgers University **Fall 2017**
  - Taught the laboratory sessions and recitations
  - Taught the tutorial of Intel Quartus Prime 16.1 and ModelSim Intel FPGA 10.5b
  - Taught the System Verilog coding for combinational and sequential logic circuits
  - Homework/exam/course project grading
- CPE390: Microprocessor Systems, Stevens Institute of Technology **Spring 2015 – Fall 2017**
  - Taught the laboratory sessions
  - Substitute instructor for teaching course chapters (e.g., Analog to Digital Conversions)
  - Homework/exam/course project grading

Mentorship

- Mentored 4 junior Ph.D. students, 4 master students, 7 undergraduate Students and 5 high school students over 8 projects in cyber security and mobile computing from Spring 2014 to Fall 2018.

PUBLICATIONS

Journal Articles:

[1] **Chen Wang**, Yan Wang, Yingying Chen, Hongbo Liu, Jian Liu, "User Authentication on Mobile Devices: Approaches, Threats and Trends", ***Computer Networks***, Under review, 2019.

[2] Yanzhi Ren, **Chen Wang**, Yingying Chen, Jie Yang, Continuous and Noninvasive Fine-grained Sleep Monitoring: Hearing Your Breathing Leveraging Smartphones, *IEEE Internet of Things Journal (**IEEE IoT**),* Accepted, 2019.

[3] Jian Liu, Hongbo Liu, Yingying Chen, Yan Wang, **Chen Wang**, "WiFi Sensing for Human Activity: A Survey", ***IEEE Communications Surveys & Tutorials***, Under review, 2019.

[4] Yanzhi Ren, **Chen Wang**, Yingying Chen, Mooi Choo Chuah, and Jie Yang, Signature Verification Using Critical Segments for Securing Mobile Transactions, *IEEE Transactions on Mobile Computing (**IEEE TMC**)*, Accepted, 2018.

[5] **Chen Wang**, Xiaonan Guo, Yingying Chen, Yan Wang, Bo Liu, "Personal PIN Leakage from Wearable Devices," in *IEEE Transactions on Mobile Computing (**IEEE TMC**)*, Volume 17, Issue 3, Pages 646-660, 2018.

[6] Jian Liu, **Chen Wang**, Yingying Chen, and Nitesh Saxena. "Good vibrations: accessing 'smart'systems by touching any solid surface." Biometric Technology Today 2018, no. 4 (2018): 7-10.

[7] **Chen Wang,** Xiuyuan Zheng, Yingying Chen, Jie Yang, "Locating Rogue Access Point using Fine-grained Channel Information", *IEEE Transactions on Mobile Computing (**IEEE TMC**)*, Volume 16, Issue 9, Pages 2560-2573, 2017.

Conference Papers and Posters:

[8] **Chen Wang**, Jian Liu, Xiaonan Guo, Yan Wang and Yingying Chen. "WristSpy: Snooping Passcodes in Mobile Payment Using Wrist-worn Wearables". in *Proceedings of IEEE International Conference on Computer Communications (**IEEE INFOCOM 2019**)*, Accepted. (Acceptance rate: 288/1464 = 19.7%)

[9] **Chen Wang**, Jian Liu, Xiaonan Guo, Yan Wang and Yingying Chen. "Poster: Inferring Mobile Payment Passcodes Leveraging Wearable Devices." in *Proceedings of the 24th Annual International Conference on Mobile Computing and Networking (**ACM MobiCom**)*, New Delhi, India, October/November 2018.
- Best Poster Award Runner-up

[10] **Chen Wang**, Jian Liu, Yingying Chen, Hongbo Liu, Yan Wang, "Towards In-baggage Suspicious Object Detection Using Commodity WiFi", in *Proceedings of IEEE International Communications and Network Security (**IEEE CNS 2018**)*, Beijing, China, May/June 2018. (Acceptance rate: 51/181 = 28.2%)
- Best paper award

[11] Jian Liu, **Chen Wang**, Yingying Chen, Nitesh Saxena, "VibWrite: Towards Finger-input Authentication on Ubiquitous Surfaces via Physical Vibration", in *Proceedings of the 24th ACM Conference on Computer and Communications Security (**CCS 2017**)*, Dallas, USA, October 2017. (Acceptance rate: 151/843 = 17.9%)

[12] **Chen Wang**, Chuyu Wang, Yingying Chen, Lei Xie, Sanglu Lu, "Smartphone Privacy Leakage of Social Relationships and Demographics from Surrounding Access Points", in *Proceedings of IEEE International Conference on Distributed Computing (**ICDCS 2017**)*, Atlanta, GA, USA, June 2017.
(Acceptance rate: 90/531 = 16.9%)

[13] **Chen Wang**, Xiaonan Guo, Yan Wang, Yingying Chen, Bo Liu, "Friend or Foe? Your Wearable Devices Reveal Your Personal PIN", in *Proceedings of the 11th ACM Symposium on Information, Computer and Communications Security (**ASIACCS 2016**)*, Xi'an, China, May 2016. (Acceptance rate: 35/183 = 19.1%)
- Best paper award

[14] Jian Liu, **Chen Wang**, Yingying Chen, "PIN Number-based Authentication Leveraging Physical Vibration: Poster", in *Proceedings of ACM Conference on Mobile Computing and Networking (**ACM MobiCom**)*, New York, USA, October 2016.

[15] Yanzhi Ren, **Chen Wang**, Yingying Chen, Mooi Choo Chuah, Jie Yang, "Critical Segment Based Real-time E-Signature for Securing Mobile Transactions", in *Proceedings of IEEE Conference on Communications and Network Security (**IEEE CNS 2015**)*, Florence, Italy, September 2015.
(Acceptance rate: 28%)

[16] Yanzhi Ren, **Chen Wang**, Jie Yang, Yingying Chen, "Fine-grained Sleep Monitoring: Hearing Your Breathing with Smartphones", in *Proceedings of IEEE International Conference on Computer Communications (**IEEE INFOCOM 2015**)*, Hong Kong, China, April 2015.
(Acceptance rate: 316/1640 = 19.3%)

[17] Xiuyuan Zheng, **Chen Wang**, Yingying Chen, Jie yang, "Accurate Rogue Access Point Localization Leveraging Fine-grained Channel Information", in *Proceedings of IEEE Conference on Communications and Network Security (**IEEE CNS 2014**)*, San Francisco, CA, USA, Oct. 2014. (Acceptance rate: 28.1%) - **Best paper award**

[18] Yanzhi Ren, **Chen Wang**, Yingying Chen, Jie Yang, "Poster: Hearing Your Breathing: Fine-grained Sleep Monitoring Using Smartphones," in *Proceedings of ACM Conference on Mobile Computing and Networking (**ACM MobiCom**)*, Maui, Hawaii, September 2014.

[19] Ming Zhan, Liang Zhou, **Chen Wang**, "A new Parallel Max-log-Map Algorithm for Double-Binary Convolutional Turbo Code Based on the Partition of Branch Metrics". in *Proceedings of the 7th International Conference on Wireless Communications, Networking and Mobile Computing*. Wuhan, China, pp. 1-4, 2011.

Patents

[20] Yingying Chen, **Chen Wang**, Jian Liu, Hongbo Liu, Yan Wang, In-Baggage Object Detection Using Commodity Wi-Fi, U.S. Provisional Patent Application No. 62/828,151, April 2019.

[21] Yingying Chen, Nitesh Saxena, Jian Liu, **Chen Wang**, Systems and methods for user input and authentication using vibration analysis, *U.S. Provisional Application No. 62/680,970, 2018*.

[22] **Chen Wang**, Liang Zhou, Ming Zhan, Lili Zeng, Fast Two-Way Parallel Decoding Algorithm for Convolutional Turbo Code, *Chinese Patent Application No. CN102340320 B, 2013*.

PROFESSIONAL SERVICES

Reviewer for Journals/Conferences

- IEEE Transactions on Wireless Communications (TWC)
- IEEE Journal on Selected Areas on Communications (JSAC)
- Journal of Computing and Information Technology (CIT)
- IEEE Communications Magazine
- ACM Computer Communications
- IEEE Wireless Communications Letters
- IEEE Conference on Communications and Network Security (CNS)
- PACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT)
- Wireless and Optical Communications Conference (WOCC)

Student Volunteer for

- ACM Conference on Mobile Computing and Networking (ACM MobiCom) 2018, New Delhi, India, October/November 2018.
- ACM Conference on Mobile Computing and Networking (ACM MobiCom) 2016, New York, USA, October 2016.
- IEEE Conference on Communications and Network Security (IEEE CNS) 2016, Philadelphia, USA, October 2016.

Technical Program Committee

- The 26th Wireless and Optical Communications Conference (WOCC 2017), Newark, USA, April 2017.