Qian Han

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I am a Ph.D. student in the Department of Computer Science at Dartmouth College, where I work at Dartmouth College Security and Artificial Intelligence Laboratory, advised by Prof. V.S. Subrahmanian. I received my Bachelor's Degree from the Department of Electronic Engineering at Tsinghua University in 2016. That year, my dissertation entitled "Hardware Design and Implementation of a Discrete Multi-channel Optically Controlled Oscillator System" won Tsinghua University's Distinguished Dissertation Award.

My research lies at the intersection of cybersecurity and artificial intelligence (AI). Specifically, I create innovative and robust technologies to help people combat cybercrime using machine learning. Examples include developing general-purpose tools for Android malware detection and analysis. Moreover, our research results on Android malware are recognized by Google Android Security Team and our research group was invited twice for a talk at Google HQ, Mountain View. I also use game theory to build strategies to predict whether severe zero-day vulnerabilities will be exploited or disclosed by nations, and how long to exploit the vulnerability if they decide to exploit. Most recently, I lead an effort to develop a general framework for adversarial malware generation using deep learning, a unified and validated set of guidelines for designing Android malware which can evade anti-virus engines. The generated samples can be used to enhance AI-based malware detection systems.

Education

Dartmouth College — Sept. 2016 – Jun. 2021 (expected)
Hanover, NH
Ph.D. candidate, Department of Computer Science

Tsinghua University — Aug. 2012 – Jul. 2016
Beijing, China
Bachelor of Engineering, Department of Electronic Engineering

Professional Experience

Now – Sept. 2017 — Research Assistant, Dartmouth College Security and Artificial Intelligence Laboratory, Hanover, NH, United States
- Proposed novel Suspicion Score & Rank features based on PageRank
- Found previously unlabeled banking Trojans and rooting malware
- Designed Ensemble Clustering and Classification algorithm synthesized training data to reduce imbalance ratio on datasets

Python | Scikit-learn | Networkx | Keras

Sept. 2019 – Jun. 2019 — Research Intern, Deutsche Telekom Innovation Laboratories, Be'er Sheva, Israel
- Designed Android-centric attack on well-known Android malware classifiers using static features
- Proposed mechanisms to enhance robustness of anti-virus engines based on deep learning and reduce impact of adversary attack

Python | PyTorch | Scikit-learn | Pandas

Aug. 2017 – Sept. 2016 — Research Assistant, Dartmouth HCI Laboratory, Hanover, NH, United States
- Designed 3D printed smart-ring prototype
- Implemented the Smart Ring control system using Python and Arduino
- Used the prototype to control the cursor and play Angry Birds

Python | Arduino | 3D printing

Sept. 2015 – Jun. 2015 — Research Assistant, Nanyang Technological University, Singapore
- Developed flight path monitoring device based on Radio Frequency using Linux GNU Radio Companion and RTL-SDR
- Implemented Gardner synchronous phase-locked loop algorithm into simulated GMSK communication system

Android Studio | GNU | MATLAB

Publications

A Data-Driven Characterization of Modern Android Spyware Aug. 2019
F. Pierazzi, G. Mezzour, **Q. Han**, M. Colajanni, V.S. Subrahmanian
Under Revision, ACM Transactions on Management Information Systems

Generating Fake Documents using Probabilistic Logic Graphs Jun. 2019
Q. Han, C. Molinaro, A. Picariello, G. Sperlì, V.S. Subrahmanian, Y. Xiong
Under Revision, IEEE Transactions on Dependable and Secure Computing

Android Rooting Malware Detection via Robust Irreversible Feature Transformations Jun. 2019
Q. Han, V.S. Subrahmanian and Y. Xiong
Under Revision, IEEE Transactions on Information Forensics and Security

Disclose or Exploit? A Game Theoretic Approach to Strategic Decision Making in Cyber Warfare Apr. 2019
H. Chen, **Q. Han**, S. Jajodia, R. Lindelauf, V.S. Subrahmanian, Y. Xiong (authors listed in alphabetic order, as a major contributor)
IEEE System Journals (ISJ'20)
https://ieeexplore.ieee.org/abstract/document/8967205

DBank : Predictive Behavioral Analysis of Recent Android Banking Trojans Apr. 2019
C. Bai, **Q. Han**, G. Mezzour, F. Pierazzi, and V.S. Subrahmanian (authors listed in alphabetic order, as a major contributor)
IEEE Transactions on Dependable and Secure Computing (TDSC'19)
https://ieeexplore.ieee.org/document/8684321

Frictio : Passive Kinesthetic Force Feedback for Smart Ring Output Jul. 2017
T. Han, **Q. Han**, M. Annett, F. Anderson, D. Huang, and X. Yang
In Proceedings of the ACM Symposium on User Interface Software and Technology (UIST'17)
https://dl.acm.org/citation.cfm?id=3126594.3126622

Low-complexity LSQR-based linear precoding for massive MIMO systems Sept. 2015
T. Xie, Z. Lu, **Q. Han**, J. Quan, B. Wang
In Proceedings of the 2015 IEEE 82nd Vehicular Technology Conference (VTC'15-Fall)
https://ieeexplore.ieee.org/document/7391016

Simultaneous Multi-Channel Reconstruction for TDS-OFDM Systems Sept. 2015
Q. Han, W. Shen, and B. Wang
In Proceedings of the 2015 IEEE 82nd Vehicular Technology Conference (VTC'15-Fall)
https://ieeexplore.ieee.org/document/7391139

Spectrum-efficiency parametric channel estimation scheme for massive MIMO systems Jun. 2014
Z. Gao, C. Zhang, C. Dai, **Q. Han**
2014 IEEE International Symposium on Broadband Multimedia Systems and Broadcasting (BMSB'14)
https://ieeexplore.ieee.org/document/6873562

Invited Talks

Clustering and Classification Methods for Predicting Malicious Android Apps Oct. 2018
Q. Han and V.S. Subrahmanian
Conference on Android Security,Local Research Day, **Google HQ**, Mountain View, CA

Behavioral Analysis and Automated Detection of Android Banking Trojans Jul. 2018
Q. Han, C. Bai and V.S. Subrahmanian
Android Security Team, **Google HQ**, Mountain View, CA

Awards

2020 Symantec Research Labs Graduate Fellowship Winners Fellowship Award Finalists
2019 Dartmouth College Graduate Student Council Student Professional Development Support Fund
2019 Dartmouth College Graduate Alumni Research Award
2019 Dartmouth College Neukom Prize for Outstanding Graduate Research
2016 Tsinghua University's Distinguished Dissertation Award
2015 First Prize of Chinese National College Students Science and Technology Innovation Project
2015 Tsinghua University Overseas Summer Research Fund
2014 Tsinghua University Science and Technology Innovation Scholarship

Languages

Mandarin
English

Skills

- **Programming language** : Python, Java, MATLAB
- **Operating systems** : Mac OS X, Linux, Windows
- **Tools and Frameworks** : LaTeX, Git, PyTorch, Keras, Android, Pandas, Scikit-learn, Networkx

Teaching Assistant Experience

2017 Spring Human-Computer Interaction, COSC 167, Dartmouth College
2017 Winter Smartphone Programming, COSC 165, Dartmouth College
2016 Fall Numerical & Computational Tools, COSC 170, Dartmouth College

Service and Leadership

Reviewer AAMAS 2020, IEEE Systems Journal 2019, 2020, IEEE Intelligent Systems 2018, IEEE Vehicular Technology Conference 2015
Student Volunteer 2015 IEEE 82nd Vehicular Technology Conference
Student Organization Leadership President of Dartmouth College Chinese Students and Scholars Association