

QISHENG ZHANG

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Github: <https://github.com/DigitalErage>|Homepage: <https://DigitalErage.github.io>

EDUCATION

Virginia Tech, Falls Church, VA, USA

Aug. 2019 - Dec. 2023

Ph.D. in Computer Science

GPA: 3.8/4.0

Courses: Introduction to Deep Learning, Network Security, Theory of Algorithms, Data Analytics, Advanced Topics in Game

Theoretic Cybersecurity, Spatial Data Management

University of Warwick, Coventry, United Kingdom

Oct. 2017 - Jul. 2018

M.S. in Mathematical Sciences (with Distinction)

GPA: 3.8/4.0

Courses: Algebraic Geometry, Representation Theory, Elliptic Curves, Commutative Algebra, Group Theory, Ring Theory

Loughborough University, Loughborough, United Kingdom

Sep. 2016 - Jun. 2017

Exchange Student in Mathematics

GPA: 87/100

Courses: Random Processes and Time Series Analysis, Introduction to Stochastic Processes, Discrete Stochastic Methods in

Finance, Continuous Stochastic Methods in Finance

Shandong University, Jinan, China

Sep. 2013 - Jun. 2017

B.S. in Mathematics and Applied Mathematics

GPA: 88/100

Courses: Differential Geometry, Abstract Algebra, Functional Analysis, General Topology, Partial Differential Equations, Mathematical Statistics, Probability Theory

SKILLS

Programming Languages: C / C++, Java, Python, MATLAB, SQL, HTML, CSS

Python Libraries: TensorFlow, PyTorch, Keras, Scikit-learn, Networkx, Jupyter, Pandas, SciPy, CARLA, SUMO, python-can

EXPERIENCE

Virginia Tech - Graduate Research Assistant

Aug. 2019 - present

Research Interests: AI-based cybersecurity, deep reinforcement learning, Natural Language Processing (NLP), autonomous driving, robotics, Internet of Things (IoT), decision-making under uncertainty, network science

Research Projects:

[1] “Uncertainty-Aware Deep Reinforcement Learning-based Defense for Resilient Cyber-Physical Systems,” funded by the US Army Research Office (2021-2024), <https://github.com/DigitalErage>

- Developed a **deep reinforcement learning**-based network adaptations for network resilience algorithm to generate robust network topologies against epidemic attacks under different system objectives in IP networks.

- Deployed the network environment with **Networkx** and the deep reinforcement learning algorithms with **Tensorflow** and **Pytorch**.

- Developed the intrusion response system for **autonomous driving** tasks with **CARLA** and **SUMO** co-simulations.

[2] “Energy Centric Wireless Sensor Node System for Smart Farms,” funded by the NSF (2021-2025),

<https://wordpress.cs.vt.edu/nsfsf>

- Leveraged **multi-agent deep reinforcement learning** and subjective logic to propose an energy-adaptive monitoring system for a solar sensor-based smart animal farm.

[3] “MUDL: Multidimensional Uncertainty-Aware Deep Learning Framework,” funded by the NSF (2021-2025)

- Proposed a **deep reinforcement learning** algorithm PPO-UE for **robotic tasks**, a PPO variant equipped with self-adaptive uncertainty-aware explorations based on a ratio uncertainty level.

- Proposed a **NLP** and **deep reinforcement learning**-based intent classification framework that can best identify the intent of fake news.

PUBLICATIONS

Journal Papers

[1] **Qisheng Zhang**, Abdullah Zubair Mohammed, Zelin Wan, Jin-Hee Cho, and Terrence J. Moore, “Diversity-By-Design for Dependable and Secure Cyber-Physical Systems: A Survey”, *IEEE Transactions on Network and Service Management*, vol. 19, no. 1, Mar. 2022 (2022 JCR IF 4.758)

[2] **Qisheng Zhang**, Jin-Hee Cho, Terrence J. Moore, and Ing-Ray Chen, “Vulnerability-Aware Resilient Networks: Software Diversity-based Network Adaptation”, *IEEE Transactions on Network Service and Management*, vol. 18, no. 3, pp. 3154–3169, Sep. 2021. (2020 JCR IF 4.195)

Conference Papers

[1] **Qisheng Zhang**, Yash Mahajan, Ing-Ray Chen, Dong Sam Ha, and Jin-Hee Cho, “An Attack-Resilient and Energy-Adaptive Monitoring System for Smart Farms”, *IEEE Global Communications Conference*, 2022.

[2] **Qisheng Zhang**, Jin-Hee Cho, Terrence J. Moore, and Frederica Free Nelson, “DREVAN: Deep reinforcement learning-based vulnerability-aware network adaptations for resilient networks”, *IEEE Conference on Communications and Network Security*, 2021.

[3] **Qisheng Zhang**, Jin-Hee Cho, and Terrence J. Moore, “Network resilience under epidemic attacks: Deep reinforcement learning network topology adaptations”, *IEEE Global Communications Conference*, 2021.

Workshop Papers

[1] **Qisheng Zhang**, Zhen Guo, Audun Jøsang, Lance Kaplan, Feng Chen, Dong Hyun Jeong, Jin-Hee Cho, “PPO-UE: Proximal Policy Optimization via Uncertainty-Aware Exploration”, *1st AAAI Workshop on Uncertainty Reasoning and Quantification in Decision Making*, 2023.

[2] Zhen Guo, Qi Zhang, Xinwei An, **Qisheng Zhang**, Audun Jøsang, Lance Kaplan, Feng Chen, Dong Hyun Jeong, Jin-Hee Cho, “Uncertainty-Aware Reward-based Deep Reinforcement Learning for Intent Analysis of Social Media Information”, *1st AAAI Workshop on Uncertainty Reasoning and Quantification in Decision Making*, 2023.

Papers Under Review

[1] Zhen Guo, Qi Zhang, **Qisheng Zhang**, Lance Kaplan, Audun Jøsang, Feng Chen, Dongseong Jeong, and Jin-Hee Cho, “Detecting Intents of Fake News Using Uncertainty-Aware Deep Reinforcement Learning”, submitted to *The Pacific-Asia Conference on Knowledge Discovery and Data Mining (PAKDD)*, Dec. 2022.

[2] **Qisheng Zhang**, Dian Chen, Y. Mahajan, Ing-Ray Chen, Dong S. Ha, and Jin-Hee Cho, “Attack-Resistant, Energy-Adaptive Monitoring for Smart Farms: Uncertainty-Aware Deep Reinforcement Learning Approach”, submitted to *IEEE Internet of Things Journal*, Oct. 2022 (2022 JCR IF 10.238).

[3] Zhen Guo*, Zelin Wan*, **Qisheng Zhang***, Xujiang Zhao*, Feng Chen, Jin-Hee Cho, Qi Zhang, Lance Kaplan, Dong Hyun Jeong, and Audun Jøsang, “A Survey on Uncertainty Reasoning and Quantification for Decision Making: Belief Theory Meets Deep Learning”, submitted to the *ACM Computing Surveys (CSUR)*, May 15, 2022 (2021 JCR IF 14.324; ranked 3/109 in Computer Science Theory & Methods; * indicates an equal contribution).

[4] **Qisheng Zhang**, Jin-Hee Cho, Terrence J. Moore, Dongseong Kim, Hyuk Lim, and Frederica F. Nelson, “EVADE: Efficient Moving Target Defense for Autonomous Network Topology Shuffling Using Deep Reinforcement Learning”, submitted to *The 21st International Conference on Applied Cryptography and Network Security (ACNS)*, Jun. 2023.

[5] Zhen Guo, **Qisheng Zhang**, Qi Zhang, Lance Kaplan, Audun Jøsang, Feng Chen, Dongseong Jeong, and Jin-Hee Cho, “mudRIA: Multidimensional Uncertainty-Aware Deep Reinforcement Learning-based Intent Analysis of Fake News Spreaders”, submitted to *The 39th Conference on Uncertainty in Artificial Intelligence (UAI)*, Jul. 2023.

[6] Lei Zhang, **Qisheng Zhang**, Zhiqian Chen, Yanshen Sun, Chang-Tien Lu, Liang Zhao, “Infinitely Deep Attributed Graph Transformation Learning”, submitted to *The Fortieth International Conference on Machine Learning (ICML)*, Jul. 2023.

Papers In Preparation

[1] **Qisheng Zhang**, Terrence J. Moore, Dongseong Kim, Hyuk Lim, Frederica F. Nelson, and Jin-Hee Cho, “Uncertainty-Aware Intrusion Response System in In-Vehicle Networks”, for a conference paper submission.

[2] **Qisheng Zhang**, Terrence J. Moore, Frederica F. Nelson, Hyuk Lim, Dongseong Kim, and Jin-Hee Cho, “Deep Reinforcement Learning-based Adaptive Moving Target Defense: Network Topology Shuffling Approach”, in preparation for a journal paper submission.

[3] Dian Chen, **Qisheng Zhang**, Ing-Ray Chen, Dong S. Ha, and Jin-Hee Cho, “Energy-Aware, Attack-Resilient Monitoring for Smart Farms Using Transfer Learning-based Deep Reinforcement Learning”, for a journal paper submission.

PROFESSIONAL PRESENTATIONS, TALKS, & BRIEFING

[1] Conference Presentation, “PPO-UE: Proximal Policy Optimization via Uncertainty-Aware Exploration,” AAAI, 7-14 Feb. 2023, Washington DC, USA (in-person).

[2] Demonstration & Technical Talk, “Deep Reinforcement Learning and Its Applications in Computer Science,” NSF-Funded Summer Workshop, *Artificial Intelligence Awareness*, Computer Science Department, University of District Columbia, Aug. 2022 (in-person).

[3] Conference Presentation, “An Attack-Resilient and Energy-Adaptive Monitoring System for Smart Farms,” *IEEE GLOBECOM*, 4–8 Dec. 2022, Rio de Janeiro, Brazil (in-person).

[4] Conference Presentation, “Analysis of Network Resilience Under Epidemic Attacks: Deep Reinforcement Learning-based Network Topology Adaptations,” *The 2021 IEEE Global Communications Conference (GLOBECOM 2021)*, Dec. 2021 (virtual).

[5] Conference Presentation, “DREVAN: Deep Reinforcement Learning-based Vulnerability-Aware Network Adaptations for Resilient Networks,” *The 2021 IEEE Conference on Communications and Network Security (CNS 2021)*, Oct. 2021 (virtual).

PAPER REVIEW SERVICES

IEEE Transactions on Services Computing (TSC)

2022 – 2023

IEEE Transactions on Network and Service Management (TNSM)

2020 – 2022

Computer Journal, Oxford Press

2020 – 2022

HONORS & AWARDS

First-Class Honours, University of Warwick

2018

Academic Scholarships, Loughborough University

2017

Academic Scholarships, Shandong University

2014–2016