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EDUCATION

Ph.D.	Management Information Systems (MIS) University of Arizona Advisor: Dr. Hsinchun Chen Minor: Cognitive Science	2019 – 2024 (Expected)
MS	Management Information Systems (MIS) University of Arizona	2018 – 2019
MBA	Master of Business Administration Colorado State University-Pueblo	2013 – 2018
BS	Computer Information Systems Colorado State University-Pueblo Graduated Cum Laude Minor: Business Management	2013 – 2018

RESEARCH INTERESTS

Domain: Cybersecurity, Vulnerability Assessment and Management, Enterprise Information Technology (IT) Security, Open-Source Software Security, Internet of Things (IoT) Security.

Method: Deep Learning (Self-Supervised Learning, Multi-View Representation Learning, Contrastive Representation Learning), Machine Learning, Network Science, Design Science.

DISSERTATION

Title: Artificial Intelligence-enabled Vulnerability Management for Enterprise IT Infrastructure: A Computational Design Science Approach

Committee Members: Dr. Hsinchun Chen (Chair), Dr. Jay F. Nunamaker Jr. (Member), Dr. Sue Brown (Member)

Dissertation Summary: Enterprise Information Technology (IT) infrastructure is comprised of a diverse array of physical (workstations, servers) and digital assets (open-source software, virtual machines) that facilitate organizational and scientific computational workflows. However, these assets often contain vulnerabilities that can inadvertently expose enterprise IT infrastructure to costly attacks from malicious hackers. Security teams must identify, prioritize, remediate, and mitigate these vulnerabilities to protect their infrastructure. However, the scale of vulnerabilities and devices often exceeds security teams' capacity to manage. In this dissertation, I partner with two NSF-funded enterprise organizations to design data-driven artifacts that address vulnerability management challenges. Guided by the computational design science paradigm, I develop novel deep learning-based artifacts to address the following questions:

- How can we automatically assess and prioritize vulnerabilities in enterprise IT infrastructure?
- How can we link vulnerabilities detected by vulnerability scanners to their remediations?
- How can we create secure computational workflow deployments in enterprise IT infrastructure?

PUBLICATIONS

Journal Publications

1. B. Ampel, **S. Ullman**. (2023) "Why Following Friends Can Hurt You: A Replication Study," *AIS Transactions on Replication Research (TRR)*, 9(1):1–15.

Journal Papers Under Review

1. **S. Ullman**, S. Samtani, H. Zhu, B. Lazarine, and H. Chen "Enhancing Vulnerability Prioritization in Cloud Computing: Grouping Vulnerable Virtual Machines using Multi-View Representation Learning" ***Under Review (Second Round) at Journal of Management Information Systems (JMIS).***
2. **S. Ullman**, H. Zhu, S. Samtani, and H. Chen "Linking Vulnerabilities in Cyberinfrastructure With Their Remediations: A Contrastive Representation Learning Approach" ***Under Review (First Round) at Information Systems Research (ISR).***

Work-In-Progress Journal Papers

1. C. Yang, **S. Ullman**, S. Samtani, H. Zhu, and H. Chen "Exploring the Propagation of Vulnerabilities in FinTech Payment Applications on GitHub: A Deep Node Ranking Approach" ***Preparing for Submission to Information Systems Research (ISR).***
2. A. Ndubizu, **S. Ullman**, S. Samtani, H. Zhu, and H. Chen "Generating Security Nutrition Labels for Internet of Things Device GitHub Repositories: A Multi-Label Classification Approach" ***Preparing for Submission to Information Systems Research (ISR).***
3. B. Lazarine, S. Samtani, H. Zhu, **S. Ullman**, and H. Chen "Detecting and Grouping Vulnerable GitHub Repositories in Scientific Cyberinfrastructure: An Unsupervised Graph Embedding Approach" ***Preparing for Submission to Journal of Management Information Systems (JMIS).***
4. **S. Ullman**, "Replication of Internet Privacy Concerns in the Context of Smart Home Devices" ***Preparing for Submission to AIS Transactions on Replication Research (TRR).***
5. R. Reyes, **S. Ullman**, S. Samtani, H. Chen "Identifying Vulnerability Persistence on Containers from Docker Hub: A Multi-View Learning Approach" ***Preparing for Submission to ACM Transactions on Management Information Systems (TMIS).***
6. **S. Ullman**, S. Samtani, H. Chen "Securing Multi-Component Workflows in Enterprise IT Infrastructure: A Graph Self-Supervised Learning Approach" ***Preparing for Submission to Information Systems Research (ISR).***

Refereed Conference Proceedings (* indicates I was the presenting author)

1. ***S. Ullman**, S. Samtani, H. Zhu, B. Lazarine, B. Ampel, M. Patton, and H. Chen "Smart Vulnerability Assessment for Scientific Cyberinfrastructure: An Unsupervised Graph Embedding Approach" *IEEE Intelligence and Security Informatics (ISI)*. Rosslyn, VA (Virtual). November 2020.
2. B. Ampel, S. Samtani, H. Zhu, **S. Ullman**, and H. Chen "Labeling Hacker Exploits for Proactive Cyber Threat Intelligence: A Deep Transfer Learning Approach" *IEEE Intelligence and Security Informatics (ISI)*. Rosslyn, VA (Virtual). November 2020. ***(Winner of the Best Paper Award).***
3. B. Lazarine, S. Samtani, M. Patton, H. Zhu, **S. Ullman**, B. Ampel, and H. Chen "Identifying Vulnerable GitHub Repositories and Users in Scientific Cyberinfrastructure: An Unsupervised Graph Embedding Approach" *IEEE Intelligence and Security Informatics (ISI)*. Rosslyn, VA (Virtual). November 2020.

Refereed Workshop Papers (No Proceedings; * indicates I was the presenting author**)**

1. ***S. Ullman** and H. Chen "VulnSSL: Identifying Relevant Vulnerability Remediation Strategies Using Self-Supervised Learning" *International Conference on Secure Knowledge Management (SKM)*. Tempe, AZ (Virtual). September 2023.
2. B. Ampel, S. Samtani, **S. Ullman**, H. Chen "Linking Common Vulnerabilities and Exposures to the MITRE ATT&CK Framework: A Self-Distillation Approach" *ACM KDD Workshop on AI-enabled Cybersecurity Analytics.* Virtual Event. August 2021.

Poster Presentations

1. M. Wisniewski, L. Irizarry, A. Hayes, S. DeHeart, K. Shu, **S. Ullman** "Automated Vulnerability Classification Using Supervised Machine Learning Methods" Colorado State University Pueblo 9th Annual Spring Symposium: A Celebration of Research, Scholarship, and Creative Activity. Pueblo, CO. April 2023.
2. M. Wisniewski, L. Irizarry, A. Hayes, S. DeHeart, K. Shu, **S. Ullman** "Cybersecurity Advisory Data Collection for Data-Driven Tools" Colorado State University Pueblo 9th Annual Spring Symposium: A Celebration of Research, Scholarship, and Creative Activity. Pueblo, CO. April 2023.

INVITED TALKS AND EXTERNAL PRESENTATIONS

1. Open Data Science Conference (ODSC) East 2023. **Presentation Title:** "AI4Cyber: An Overview of Artificial Intelligence for Cybersecurity and an Open-Source Virtual Machine" May 9, 2023. Co-Presenter.
2. 56th Hawaii International Conference on System Sciences (HICSS). **Symposium Title:** "AI in Cybersecurity – Machine Learning/Deep Learning Data Analytics" January 3, 2023. Co-Presenter.
3. Open Data Science Conference (ODSC) West 2022. **Presentation Title:** "AI4Cyber: An Overview of the Field and an Open-Source Virtual Machine for Research and Education" November 2, 2022. Co-Presenter.
4. Inaugural University of Arizona MS Cybersecurity Board of Advisors Meeting. **Presentation Title:** "Detecting and Grouping Vulnerable Virtual Machines in Public Clouds: A Multi-View Representation Learning Approach" April 8, 2022.
5. NSF Cybersecurity Summit Vulnerability Management Workshop. **Presentation Title:** "Detecting and Grouping Vulnerable Virtual Machines in Scientific Cyberinfrastructure" October 19, 2021.
6. NSF Cybersecurity Summit Vulnerability Management Workshop. **Presentation Title:** "Detecting and Linking Vulnerabilities in Scientific Cyberinfrastructure to MITRE ATT&CK" October 19, 2021.

PROFESSIONAL SERVICE

Ad-hoc Reviewer: Journal Publications

- ACM Digital Threats: Research and Practice (DTRAP), 2022, 2023.
- Computers & Security, 2022, 2023.
- IEEE Transactions on Dependable and Secure Computing (TDSC), 2021.
- ACM Transactions on Management Information Systems (TMIS), 2019.

Ad-hoc Reviewer: Refereed Conference Proceedings

- Hawaii International Conference on System Sciences (HICSS), 2021, 2023.
- Pacific Asia Conference on Information Systems (PACIS), 2020-2023.
- International Conference on Information Systems (ICIS), 2020, 2021.
- IEEE Security and Privacy Deep Learning and Security Workshop (DLS) 2020.
- ICDM Workshop on Deep Learning for Cyber Threat Intelligence (DL-CTI), 2020.
- INFORMS Workshop on Data Science (WDS), 2022.

Conference Committees

- Program Committee, INFORMS Workshop on Data Science (WDS), 2022.
- Program Committee, ACM Conference on Computer and Communications Security (CCS) AISec Workshop, 2021.
- Program Committee, Workshop on Artificial Intelligence-enabled Cybersecurity Analytics (AI4Cyber-KDD), 2021, 2023.

HONORS AND AWARDS

Awards:

- Winner, Paul S. and Shirley Goodman Award in International Computer Technology. 2021-2022.
- Winner, Samtani-Garcia MIS Ph.D. Commitment Scholarship. 2021-2022.
- Winner, Best Paper Award, IEEE Intelligence and Security Informatics (ISI). 2020.
- Winner, Nunamaker-Chen Doctoral Student Scholarship. 2020.

Other:

- Doctoral Consortium, Americas Conference on Information Systems (AMCIS). 2023.

TEACHING EXPERIENCE

University Courses:

Role	Semester	Course	Location	# Students
Co-Instructor	Spring 2023	MIS 689: Cyber Warfare Capstone	UArizona	27
GTA	Spring 2023	MIS 611D: Topics in Data and Web Mining	UArizona	12
GTA	Spring 2023	MIS 464: Data Analytics	UArizona	43
Instructor	Spring 2023	CIS 490: Special Topics	CSU-Pueblo	5
Co-Instructor	Fall 2022	MIS 689: Cyber Warfare Capstone	UArizona	11
Co-Instructor	Spring 2022	MIS 689: Cyber Warfare Capstone	UArizona	16
Co-Instructor	Fall 2021	MIS 689: Cyber Warfare Capstone	UArizona	13
Co-Instructor	Spring 2021	MIS 689: Cyber Warfare Capstone	UArizona	4
GTA	Fall 2020	MIS 689: Cyber Warfare Capstone	UArizona	17
GTA	Spring 2020	MIS 689: Cyber Warfare Capstone	UArizona	3
GTA	Fall 2019	MIS 689: Cyber Warfare Capstone	UArizona	15
GTA	Spring 2019	MIS 689: Cyber Warfare Capstone	UArizona	3

External:

- **AZ Cyber Initiative – Cyber Bootcamp** (High School Bootcamp). 2021 (Inaugural Year), 2022. Instructor.

GRANT EXPERIENCE

- **Year:** 2023. **Funding Source:** National Science Foundation. **Grant Title:** "CICI: UCSS: Enhancing the Usability of Vulnerability Assessment Results for Open-Source Software Technologies in Scientific Cyberinfrastructure: A Deep Learning Perspective" **Funding Amount:** $600,000. **Role:** Assisting Grant Writer. **Status:** Awarded.
- **Year:** 2022. **Funding Source:** National Science Foundation. **Grant Title:** "CICI: UCSS: Enhancing the Usability of Vulnerability Assessment Results for Open-Source Software Technologies in Scientific Cyberinfrastructures: A Deep Learning Perspective" **Funding Amount:** $600,000. **Role:** Assisting Grant Writer. **Status:** Not Funded (Low Competitive).
- **Year:** 2022. **Funding Source:** National Science Foundation. **Grant Title:** "CISE-MSI: DP: SaTC: MSI Research Capacity Building for Artificial Intelligence (AI)-enabled Vulnerability Assessment and Remediation in Cyberinfrastructure" **Funding Amount:** $600,000. **Role:** Lead Author. **Duration:** 2022-2025. **Status:** Awarded.
- **Year:** 2021. **Funding Source:** National Science Foundation. **Grant Title:** "CCRI: New: CCRI for Cybersecurity: An Artificial Intelligence (AI)-enabled Cybersecurity Analytics Perspective" **Funding Amount:** $2,000,000. **Role:** Assisting Grant Writer. **Status:** Not Funded (Competitive).
- **Year:** 2020. **Funding Source:** National Science Foundation. **Grant Title:** "CICI: SIVD: Proactively Detecting and Categorizing Configuration and Social Coding Vulnerabilities in Scientific

Cyberinfrastructure: An AI-enabled Vulnerability Discovery Approach" **Funding Amount:** $492,000. **Role:** Assisting Grant Writer. **Status:** Not Funded (Competitive).

- **Year:** 2020. **Funding Source:** NSF XSEDE. **Grant Title:** "Exploratory Study of Scientific Cyberinfrastructure for Information Systems Research" **Funding Amount:** $2,000. **Role:** Allocation Manager. **Status:** Awarded.

WORK EXPERIENCE

University of Arizona August 2018 – Present
Graduate Research/Teaching Assistant

The MITRE Corporation May 2019 – August 2019
Cybersecurity Intern

Institutional Research (CSU-Pueblo) May 2017 – May 2018
Data Analytics Assistant

PROFESSIONAL AFFILIATIONS

- Association for Information Systems (AIS), Member.
- Institute for Operations Research and Management Sciences (INFORMS), Member.
- Information Systems Society (ISS), Member.
- Institute of Electrical and Electronics Engineers (IEEE), Member.
- Association for Computing Machinery (ACM), Member.

TECHNICAL SKILLS

- **Databases:** Oracle, MySQL, MongoDB.
- **Programming Languages:** Python, R, Bash.
- **Visualization:** Tableau, Gephi.
- **Data Mining Tools:** RapidMiner, SPSS, scikit-learn.
- **Deep Learning Modules:** Tensorflow, Keras, PyTorch.
- **Security Tools:** Nmap, Wireshark, SQLMap, Metasploit, Meterpreter, Hydra, Nessus, BurpSuite.
- **Operating Systems:** Linux (Ubuntu, CentOS, Kali), Windows.

PROFESSIONAL REFERENCES

1. **Hsinchun Chen, Ph.D. (Dissertation Committee Chair)**
   Regents' Professor and Thomas R. Brown Chair of Management and Technology
   Director, Artificial Intelligence Lab
   Eller College of Management, The University of Arizona
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2. **Jay F. Nunamaker Jr., Ph.D. (Dissertation Committee Member)**
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3. **Sue Brown, Ph.D. (Dissertation Committee Member)**
   Stevie Eller Professor
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4. **Sagar Samtani, Ph.D.**
   Assistant Professor and Arthur M. Weimer Faculty Fellow
   Director, Data Science and Artificial Intelligence Lab (DSAIL)
   Kelley School of Business, Indiana University
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5. **Hongyi Zhu, Ph.D.**
   Assistant Professor
   Alvarez College of Business, The University of Texas at San Antonio
   1 UTSA Circle, NPB 3.138E02
   San Antonio, TX 78249-0600
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   Phone: +1 (210)-458-8030