Ankit Shah

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Research, Teaching, and Service Highlights

- Research interests are at the intersection of Computer Science, Operations Research, Data Science, and Information Technology, with a strong focus on **Artificial Intelligence for Cybersecurity and other Defense Applications**

- Active research investigations include the development of **resilient network architectures**, the **design of optimal security policies**, and the **optimization of vulnerability management** to enhance organizational cybersecurity

- Methodological research focus areas include **Deep Reinforcement Learning, Security-aware Machine Learning,** and **Combinatorial Optimization**

- Research sponsors include the Department of Defense (DoD), the Department of Homeland Security (DHS), and industry partners

- **Deputy Director of Cybersecurity**, Data Science and Artificial Intelligence Laboratory, Kelley School of Business, Indiana University, July 2024-Present

- **Director**, **Artificial Intelligence Research Laboratory for Secure and Efficient Systems**, USF, 2019-2024

- **28 peer-reviewed articles, three book chapters**, and **numerous invited talks** at conferences, government organizations, and with industry partners.

- **One utility patent issued** and **two utility patents pending** (for AI-enabled solution methods for cyber and physical security problems)

- **2023 Outstanding Research Achievement Award** recipient from USF Research and Innovation

- **2022 Outstanding Research Achievement Award** recipient from USF Research and Innovation

- **2021-2022 Outstanding Undergraduate Teaching Award** recipient from USF Provost Office

- **2022 Outstanding Teaching Award** recipient from USF College of Engineering's Academy of Distinguished Engineering Educators

- **Teaching Innovations:** Developed two graduate-level courses: (i) **Decision-making with Deep Reinforcement Learning** and (ii) **Cybersecurity Analytics**, and an undergraduate-level course: (iii) **Applied Data Science**, USF, 2020-2023

- Two supervised **doctoral students received nationally competitive scholarships** (INFORMS Military and Security Society Seth Bonder's Award and National Academies Airport Cooperative Research Program Award, 2022-2023)

- Senior Member, IEEE

- Member, Institute for Artificial Intelligence + X (AI+X), USF, January 2020 - June 2024

- Cluster Chair, Cybersecurity, INFORMS 2020 and 2022

- AI and Optimization research highlighted by INFORMS for government policymakers demonstrating the impact in Cybersecurity, 2021

- Research work on Adversarial Reinforcement Learning for Robust Screening of Cyberattacks highlighted by the U.S. Army CCDC ARL Public Affairs, July 2020
- USF (NSF) I-Corps Fellow, March 2020
- Top Student Research Collaborator Award Recipient for the DoD Multidisciplinary University Research Initiative project sponsored by the Army Research Office, 2017
- Distinguished Academic Achievement Award in Operations Research, George Mason University, Fairfax, VA, 2016

Research and Teaching Experience

- Assistant Professor of Operations and Decisions Technologies, Kelley School of Business, Indiana University, Bloomington, IN, July 2024 – Present
- Assistant Professor of Industrial and Management Systems Engineering, University of South Florida, Tampa, FL, August 2019 – June 2024
- Affiliate Assistant Professor of Computer Science and Engineering, University of South Florida, Tampa, FL, October 2019 – June 2024
- Affiliate Assistant Professor of Electrical Engineering, University of South Florida, Tampa, FL, March 2023 – June 2024
- Postdoctoral Reinforcement Learning Researcher, Computational Engineering Directorate, Lawrence Livermore National Laboratory, Livermore, CA, Mar 2019 – July 2019
- Graduate Researcher, Center for Secure Information Systems, George Mason University, Fairfax, VA, May 2015 – 2019

Academic Degrees

- Ph.D. in Information Technology, George Mason University, Fairfax, VA, Spring 2019
  - Dissertation: *Decision Analytics for Optimal Performance of a Cybersecurity Operations Center*
- M.S. in Operations Research, George Mason University, Fairfax, VA, Spring 2016
- B.S. in Computer Science, Florida Atlantic University, Boca Raton, FL, Fall 2001

Research Grants

1. *Towards Open World Recognition for Network Intrusion Detection Systems: An Adversarial Deep Reinforcement Learning Approach*, Principal Investigator, the U.S. Army (USMA), $398,999, 03/2022-12/2024
2. *Securing Large Language Models: Uncovering Threats and Strengthening Safety Training*, Principal Investigator, STTR Phase I Project from the Department of the Air Force in collaboration with Mobius Logic, $110,000, 12/2023 - 04/2024

3. *Testing & Evaluation for Soldier-Device Teaming Compatibility, Vulnerability, and Durability in Emergent Situations (Project 6.4: Vehicle AI Energy Efficiency Considerations)*, Co-Principal Investigator, the U.S. Army, $1,056,934, 01/2022-12/2026
4. *Maritime Artificial Intelligence and Automation Research*, Principal Investigator, U.S. Special Operations Command, $136,638, 05/2022-10/2022
5. *Towards Ending the HIV Epidemic: A Deep Reinforcement Learning Approach to Diagnose, Treat, and Prevent HIV*, USF Principal Investigator (subaward from the University of Massachusetts Amherst), National Institute of Health, $50,000, 07/2022-06/2023
6. *An AI Approach for Cosmetic Defect Detection to Improve Product Quality Control*, Principal Investigator, Industry grant award from Jabil and Florida High Tech Corridor, $200,000, 04/01/2021 – 03/31/2022
7. *An AI-based Hazard Detection Approach Towards Securing Airfield Runways*, USF Principal Investigator, SBIR Phase II Project from the U.S. Department of the Air Force (AvaWatz), $1M, 08/03/20 - 02/02/2022
8. *Protecting Soft Targets and Crowded Places: An Adversarial Learning Approach to Threat Reduction*, USF Principal Investigator, SBIR Phase I Project from the Department of Homeland Security (AvaWatz), $150,000, 06/01/20 - 11/30/2020
9. *Sensor to Sense-Making: A Machine Learning Approach to Developing Intelligence from Wide-area Motion Imagery Data*, Industry grant award from AvaWatz, $50,000, 02/01/2020-07/31/2020

Publications (* denotes supervised students, underline denotes corresponding author)

Peer-Reviewed Articles (accepted/published):

1. *Soumyadeep Hore, *Jalal Ghadermazi, Ankit Shah, Nathaniel Bastian, "A sequential deep learning framework for a robust and resilient network intrusion detection system," *Computers and Security*, Vol. 144, No. 103928, 2024. DOI: https://doi.org/10.1016/j.cose.2024.103928
2. *Jalal Ghadermazi, Ankit Shah, Nathaniel Bastian, "Towards real-time network intrusion detection with image-based sequential packets representation," *IEEE Transactions on Big Data*, 2024. DOI: https://doi.ieeecomputersociety.org/10.1109/TBDATA.2024.3403394
3. *Mohammad Noroozi, Ankit Shah, "An open world foreign object debris detection framework empowered by generative adversarial network and computer vision models," *Transportation Research Record*, First Online: 14 June 2024. DOI: https://doi.org/10.1177/03611981241246263
4. *Jalal Ghadermazi, Ankit Shah, Sushil Jajodia, "A machine learning and optimization framework for efficient alert management in a cybersecurity operations center," *ACM Digital Threats: Research and Practice (DTRAP)*, First Online: 05 February 2024. DOI: https://dl.acm.org/doi/10.1145/3644393
5. *Soumyadeep Hore, *Quoc Nguyen, Yulun Xu, Ankit Shah, Nathaniel Bastian, Trung Le, "Empirical evaluation of autoencoder models for anomaly detection in packet-based network intrusion detection systems," *Proc. 2023 IEEE Conference on Dependable and Secure Computing (DSC)*, TAMPA, FL, USA, 2023, pages 1-8. DOI: 10.1109/DSC61021.2023.10354098

6. *Mohammad Noroozi, *Jalal Ghadermazi, <u>Ankit Shah</u>, José L. Zayas-Castro, "Towards optimal defect detection in assembled printed circuit boards under adverse conditions," *IEEE Access*, First Online: 06 November 2023. DOI: 10.1109/ACCESS.2023.3330142

7. *Mohammad Noroozi, Hanieh Rastegar Moghaddam, <u>Ankit Shah</u>, Hadi Charkhgard, Sudeep Sarkar, Tapas K. Das, Timothy Pohland, "An AI-assisted systematic literature review of the impact of vehicle automation on energy consumption," *IEEE Transactions on Intelligent Vehicles (T-IV)*. First Online: 20 April 2023. DOI: 10.1109/TIV.2023.3268300

8. *Soumyadeep Hore, <u>Ankit Shah</u>, Nathaniel Bastian, "Deep VULMAN: A deep reinforcement learning-enabled cyber vulnerability management framework," *Elsevier Expert Systems with Applications (ESWA)*, Vol. 221, No. 119734, 2023. DOI: https://doi.org/10.1016/j.eswa.2023.119734

9. Ankit Shah, Rajesh Ganesan, Sushil Jajodia, Hasan Cam, Steve Hutchinson, "A novel team formation framework based on performance in a cybersecurity operations center," *IEEE Transactions on Services Computing (TSC),* First Online: 06 March 2023. DOI: 10.1109/TSC.2023.3253307

10. *Mohammad Noroozi, <u>Ankit Shah</u>, "Towards optimal foreign object debris detection in an airport environment," *Elsevier Expert Systems with Applications (ESWA),* Vol. 213, No. 118829, 2023. DOI: https://doi.org/10.1016/j.eswa.2022.118829

11. *Soumyadeep Hore, *Fariha Moomtaheen, <u>Ankit Shah</u>, Xinming Ou, "Towards optimal triage and mitigation of context-sensitive cyber vulnerabilities," *IEEE Transactions on Dependable and Secure Computing (TDSC)*, 2022. First Online: 22 February 2022. DOI: 10.1109/TDSC.2022.3152164

12. Ankit Shah, Rajesh Ganesan, Sushil Jajodia, Hasan Cam, "Maintaining the level of operational effectiveness of a CSOC under adverse conditions," *Springer International Journal of Information Security (IJIS),* Vol. 21, 2022, pages 637-651. DOI: 10.1007/s10207-021-00573-4

13. Aigerim Bogyrbayeva, Sungwook Jang, Ankit Shah, Young Jae Jang, Changhyun Kwon, "A reinforcement learning approach for rebalancing electric vehicle sharing systems," *IEEE Transactions on Intelligent Transportation Systems*, Vol. 23, No. 7, 2022, pages 8704-8714. DOI: 10.1109/TITS.2021.3085217

14. *Jalal Ghadermazi, *Soumyadeep Hore, *Dinesh Sharma, <u>Ankit Shah</u>, "Adversarial deep reinforcement learning enabled threat analytics framework for constrained spatio-temporal movement intelligence data," *2021 IEEE International Conference on Intelligence and Security Informatics (ISI)*, 2021, pp. 1-6, DOI: 10.1109/ISI53945.2021.9624731

15. Ankit Shah, Arunesh Sinha, Rajesh Ganesan, Sushil Jajodia, Hasan Cam, "Two can play that game: An adversarial evaluation of a cyber-alert inspection system," *ACM Transactions on Intelligent Systems and Technology (TIST)*, Vol. 11, No. 3, 2020, pages 32:1-32:20. DOI: 10.1145/3377554

16. Ankit Shah, Rajesh Ganesan, Sushil Jajodia, Hasan Cam, "An outsourcing model for alert analysis in a Cybersecurity Operations Center," *ACM Transactions on the Web (TWEB)*, Vol. 14, No. 1, January 2020. DOI: 10.1145/3372498

17. Ankit Shah, Rajesh Ganesan, Sushil Jajodia, Pierangela Samarati, Hasan Cam, "Adaptive alert management for balancing optimal performance among distributed CSOCs using reinforcement learning," *IEEE Transactions on Parallel and Distributed Systems (TPDS),* 2019. First Online: 15 July 2019. DOI: 10.1109/TPDS.2019.2927977

18. Ankit Shah, Katheryn A. Farris, Rajesh Ganesan, Sushil Jajodia, "Vulnerability selection for remediation: An empirical analysis," *Journal of Defense Modeling and Simulation (JDMS),* First Online: September 17, 2019. DOI: 10.1177/1548512919874129

19. Ankit Shah, Rajesh Ganesan, Sushil Jajodia, Hasan Cam, "A two-step approach to optimal selection of alerts for investigation in a CSOC," *IEEE Transactions on Information Forensics and Security (TIFS),* Vol. 14, No. 7, July 2019, pages 1857-1870. First Online: 12 December 2018. DOI: 10.1109/TIFS.2018.2886465

20. Ankit Shah, Rajesh Ganesan, Sushil Jajodia, Hasan Cam, "Understanding trade-offs between throughput, quality, and cost of alert analysis in a CSOC," *IEEE Transactions on Information Forensics and Security (TIFS),* Vol. 14, No. 5, May 2019, pages 1155-1170*.* First Online: 24 September 2018. DOI: 10.1109/TIFS.2018.2871744

21. Ankit Shah, Rajesh Ganesan, Sushil Jajodia, "A methodology for ensuring fair allocation of CSOC effort for alert investigation," *Springer International Journal of Information Security (IJIS),* Vol. 18, No. 2, 2019, pages 199-218*.* First Online: 09 May 2018. DOI: 10.1007/s10207-018-0407-3

22. Katheryn A. Farris, Ankit Shah, George Cybenko, Rajesh Ganesan, Sushil Jajodia, "VULCON - A system for vulnerability prioritization, mitigation, and management," *ACM Transactions on Privacy and Security (TOPS)*, Vol. 21, No. 4, May 2018, pages 16:1-16:28. DOI: 10.1145/3196884

23. Ankit Shah, Rajesh Ganesan, Sushil Jajodia, Hasan Cam, "Dynamic optimization of the level of operational effectiveness of a CSOC under adverse conditions," ACM Transactions on Intelligent Systems and Technology (TIST), Vol. 9, No. 5, 2018. DOI: 10.1145/3173457

24. Ankit Shah, Rajesh Ganesan, Sushil Jajodia, Hasan Cam, "Optimal assignments of sensors to analysts in a cybersecurity operations center," *IEEE Systems Journal,* Vol. 13, No. 1, March 2019, pages 1060-1071. First Online: 05 April 2018. DOI: 10.1109/JSYST.2018.2809506

25. Ankit Shah, Rajesh Ganesan, Sushil Jajodia, Hasan Cam, "A methodology to measure and monitor level of operational effectiveness in a CSOC," *Springer International Journal of Information Security (IJIS),* Vol. 17, No. 2, 2018. pages 121-134*.* DOI*:* 10.1007/s10207-017-0365-1

26. Ankit Shah, Rajesh Ganesan, Sushil Jajodia, Hasan Cam, "Adaptive reallocation of cybersecurity analysts to sensors for balancing risks between sensors," *Springer Service Oriented Computing and Applications*, Vol. 12, No. 2, 2018, pages 123-135. DOI:10.1007/s11761-018-0235-3

27. Sridhar Venkatesan, Massimiliano Albanese, Ankit Shah, Rajesh Ganesan, Sushil Jajodia, "Detecting stealthy botnets in a resource-constrained environment using reinforcement learning," *Proc. 4th ACM Workshop on Moving Target Defense (MTD 2017),* Dallas, TX, October 30, 2017. DOI: 10.1145/3140549.3140552

28. Rajesh Ganesan, Sushil Jajodia, Ankit Shah, Hasan Cam, "Dynamic scheduling of cybersecurity analysts for minimizing risk using reinforcement learning," *ACM Transactions on Intelligent Systems and Technology (TIST),* Vol. 8, No. 1, 2016. DOI: 10.1145/2882969

Book Chapters:

1. Rajesh Ganesan, Ankit Shah, Sushil Jajodia, Hasan Cam, "Optimizing alert data management processes at a cyber security operations center," in Adversarial and Uncertain Reasoning for Adaptive Cyber-Defense, Springer Lecture Notes in Computer Science (State-of-the-Art Survey Series), Sushil Jajodia, George Cybenko, Peng Liu, Cliff Wang, Michael Wellman, eds., Vol. 11830, 2019, pages 206-231. DOI: 10.1007/978-3-030-30719-6_9
2. Rajesh Ganesan, Ankit Shah, "A strategy for effective alert analysis at a cybersecurity operations center," in From Database to Cyber Security: Essays Dedicated to Sushil Jajodia on the Occasion of His 70th Birthday, Pierangela Samarati, Indrajit Ray, Indrakshi Ray, eds., Springer Lecture Notes in Computer Science, 2018, pages 206-226. DOI: 10.1007/978-3-030-04834-1_11
3. Rajesh Ganesan, Ankit Shah, Sushil Jajodia, Hasan Cam, "A novel metric for measuring operational effectiveness of a cybersecurity operations center," in Network Security Metrics, Lingyu Wang, Sushil Jajodia, Anoop Singhal, eds., Springer, 2017, pages 177-207. DOI: 10.1007/978-3-319-66505-4_8

Patent and Intellectual Property (* denotes supervised students)

1. Utility Patent (co-inventors: *Soumyadeep Hore and *Dinesh Sharma) for the invention titled, "System and Method for Reducing a Threat Footprint of an Area-of-Interest," issued on 08/20/2024 (U.S. Patent #12,067,857).

Talks and Presentations (* denotes supervised students)

1. Invited talk titled, "Advancing robustness and resilience in network intrusion detection mechanisms," Technical Exchange Meeting, United States Military Academy (hosted at Northeastern University, Boston, MA), August 2024
2. Accepted talk titled, "FedNIDS: A federated learning framework for packet-based network intrusion detection system (*Quoc Nguyen)," 2024 INFORMS Security Conference, Arlington, VA, July 2024
3. Accepted talk titled, "Deep ResNIDS: A sequential deep learning framework for a robust and resilient network intrusion detection system (*Soumyadeep Hore)," 2024 INFORMS Security Conference, Arlington, VA, July 2024
4. Accepted paper titled, "Learning to evade: Realistic adversarial network packet generation using deep reinforcement learning," Workshop on Artificial Intelligence for Cyber Security (AICS), AAAI 2024, Vancouver, BC, Canada, February 2024
5. Invited talk titled, "A sequential deep learning framework for a robust and resilient network intrusion detection system (*Soumyadeep Hore)," Technical Exchange Meeting, United States Military Academy (hosted at George Washington University, Washington, DC), January 2024
6. Invited talk titled, "An open world foreign object debris detection framework empowered by generative adversarial network and computer vision models (*Mohammad Noroozi)," 2024 Annual Transportation Research Board (TRB) Meeting, Washington, DC, January 2024

7. Invited talk titled, "A novel team formation framework based on performance in a cybersecurity operations center," 2023 INFORMS Annual Meeting, Phoenix, AZ, October 2023
8. Invited talk titled, "Towards real-time network intrusion detection with image-based sequential packets representation (*Jalal Ghadermazi)," 2023 INFORMS Annual Meeting, Phoenix, AZ, October 2023
9. Invited talk titled, "Enhancing open-world recognition: an innovative framework for robust detection of unknown instances (*Mohammad Noroozi)," 2023 INFORMS Annual Meeting, Phoenix, AZ, October 2023
10. Invited talk titled, "A multi-agent reinforcement learning approach to identify optimal intervention options for 'Ending the HIV Epidemic (*Dinesh Sharma)," 2023 INFORMS Annual Meeting, Phoenix, AZ, October 2023
11. Invited talk titled, "A deep reinforcement learning framework for adversarial example generation to deceive network intrusion detection systems (*Soumyadeep Hore)," 2023 INFORMS Annual Meeting, Phoenix, AZ, October 2023
12. Invited talk titled, "Towards open world recognition for NIDS: An Adversarial DRL Approach," United States Military Academy, West Point, NY, November 2022
13. Invited talk titled, "A reinforcement learning approach to maintaining the level of operational effectiveness of a cyber security operations center under adverse conditions," 2022 INFORMS Annual Meeting, Indianapolis, IN, October 2022
14. Invited talk titled, "Empowering object detection models in dynamic environments with novel data sampling and augmentation techniques (*Mohammad Noroozi, Ankit Shah)," 2022 INFORMS Annual Meeting, Indianapolis, IN, October 2022
15. Invited talk titled, "A machine learning and optimization approach to optimal alert investigation (*Jalal Ghadermazi)," 2022 INFORMS Annual Meeting, Indianapolis, IN, October 2022
16. Invited talk titled, "Towards robust cyber vulnerability management (*Soumyadeep Hore)," 2022 INFORMS Annual Meeting, Indianapolis, IN, October 2022
17. Seminar on "AI and Automation for Maritime Applications," Program Executive Office for Maritime, USSOCOM, August 2022
18. Spotlight talk titled, "An artificial intelligence-enabled framework for optimizing the dynamic cyber vulnerability management process (*Soumyadeep Hore)," International Conference on Machine Learning (ICML) 2022 Workshop on Machine Learning for Cybersecurity, Baltimore, MD, July 2022
19. Invited talk titled, "Adversarial deep reinforcement learning enabled threat analytics framework for constrained spatio-temporal movement intelligence data (*Jalal Ghadermazi)," 2022 INFORMS Computing Society Conference, Tampa, FL, January 2022
20. Invited talk titled, "Cyber vulnerability management: A deep reinforcement learning approach (*Soumyadeep Hore)," 2022 INFORMS Computing Society Conference, Tampa, Florida, January 2022
21. Invited talk titled, "Adversarial deep reinforcement learning enabled threat analytics framework for constrained spatio-temporal movement intelligence data (*Soumyadeep

Hore),” 19th Annual IEEE International Conference on Intelligence and Security Informatics, San Antonio, TX, November 2021

22. Invited talk titled, “Data augmentation for object detection models: A case study (*Mohammad Noroozi),” 2021 INFORMS Annual Meeting, Anaheim, CA, October 2021

23. Invited talk titled, “A simulation-based movement intelligence model for building threat intelligence (*Jalal Ghadermazi),” 2021 INFORMS Annual Meeting, Anaheim, CA, October 2021

24. Invited talk titled, “Dynamic vulnerability prioritization using deep reinforcement learning (*Soumyadeep Hore),” 2021 INFORMS Annual Meeting, Anaheim, CA, October 2021

25. Invited talk titled, “Building threat intelligence in ISR systems: A machine learning approach to knowledge management (*Jalal Ghadermazi),” International Conference on Secure Knowledge Management, San Antonio, TX, October 2021

26. Invited talk titled, “Maintaining the level of operational effectiveness of a cybersecurity operations center under adverse conditions,” Multidisciplinary University Research Initiative (MURI) on Adaptive Cyber Defense, Army Research Office (ARO), September 2021

27. Invited talk titled, “An AI-based methodology for soft targets and crowded places vulnerability mitigation,” Department of Homeland Security (DHS), November 2020

28. Invited talk titled, “Towards optimal triage and mitigation of cyber vulnerabilities,” Cybersecurity Analytics, INFORMS Annual Meeting 2020, Seattle, WA, October 2020

29. Invited talk titled, “Deep reinforcement learning based adversarial evaluation of a cyber alert management system,” Deep Learning and Neural Networks, INFORMS Annual Meeting 2019, Seattle, WA, October 2019

30. Invited talk titled, “A two-step approach to optimal selection of alerts for investigation in a cybersecurity operations center,” Operations Research and Cyber, INFORMS Annual Meeting 2019, Seattle, WA, October 2019

31. Invited talk titled, “Dynamic optimization of the level of operational effectiveness of a cybersecurity operations center under adverse conditions,” Optimization under uncertainty, INFORMS Annual Meeting 2018, Phoenix, AZ, November 2018

32. Invited talk titled, “Dynamic optimization of the level of operational effectiveness of a cybersecurity operations center,” INFORMS Optimization 2018, Denver, CO, March 2018

33. Invited talk titled, “A methodology to measure, monitor, and control the level of operational effectiveness of a CSOC,” Emerging Techniques Forum, Military Operations Research Society, Alexandria, VA, December 2017

34. Invited talk titled, “Predicting the relevance of search results using text mining and predictive analytics,” Analytics Center of Excellence, Social Security Administration, Falls Church, VA, December 2017

35. Invited talk titled, “A methodology to measure and monitor level of operational effectiveness of a CSOC,” INFORMS 2017, Houston, TX, October 2017

36. Technical seminar and software demonstration on “Cybersecurity analyst scheduling for an optimal level of operational effectiveness” at General Dynamics, VA, August 2017

37. Technical seminar and software demonstration on "Grouping of sensors and allocation to analysts for minimizing risk" at Army Research Laboratory, Adelphi, MD, July 2017
38. Invited talk titled, "A methodology to measure and monitor level of operational effectiveness of a CSOC", IFORS 2017, Quebec, Canada, July 2017
39. Technical seminar and software demonstration on "Optimal scheduling of cybersecurity analysts for minimizing risk" at Northrop Grumman, VA, April 2017
40. Technical seminar and software demonstration at Army Research Laboratory, Adelphi, MD, August 2015, January 2016, August 2016

Teaching and Mentoring

Teaching Evaluations (at USF):

Term	Course Title	Percent Response (%)	Overall Rating (from 5)
Spring 2024	ESI 6613 901 APPLIED DATA INTELLIGENCE	47	4.75
Fall 2023	ESI 6684 001 DECISION-MAKING WITH DEEP RL	60	4.88
Spring 2023	ESI 4607 001 ANALYTICS II: APPLIED DATA SCIENCE	31.91	4.60
Spring 2023	ESI 4607 701 ANALYTICS II: APPLIED DATA SCIENCE	21.05	4.75
Spring 2023	ESI 6613 001 APPLIED DATA INTELLIGENCE	50	4.67
Spring 2023	ESI 6613 701 APPLIED DATA INTELLIGENCE	75	4.33
Fall 2022	ESI 6683 001 CYBER SECURITY ANALYTICS	83	5
Fall 2022	ESI 6683 701 CYBER SECURITY ANALYTICS	75	5
Spring 2022	EIN 6936 001 ENGINEERING ANALYTICS II	75	4.92
Spring 2022	EIN 6936 702 ENGINEERING ANALYTICS II	100	5
Spring 2022	ESI 4607 001 ENGINEERING ANALYTICS II	30	4.42
Spring 2022	ESI 4607 701 ENGINEERING ANALYTICS II	35.29	4.67
Fall 2021	EIN 6935 001 DECISION-MAKING WITH DEEP RL	90.91	5
Spring 2021	EIN 6936 001 ENGINEERING ANALYTICS II	62.5	5
Spring 2021	ESI 4607 001 ENGINEERING ANALYTICS II	37.5	5
Spring 2021	ESI 4607 701 ENGINEERING ANALYTICS II	37.78	4.82
Fall 2020	EIN 6935 001 CYBER ANALYTICS	83.33	5
Fall 2020	EIN 6935 701 CYBER ANALYTICS	88.89	4.75
Spring 2020	EIN 6936 001 ENGINEERING ANALYTICS II	50	5
Spring 2020	ESI 4607 001 ENGINEERING ANALYTICS II	34	4.47
Spring 2020	ESI 4607 701 ENGINEERING ANALYTICS II	28	4.86

Sample comments from students about the courses and teaching:

o *"Great class. Really expanded my knowledge on data intelligence through the projects, I feel way better with data intelligence than before this course. Ankit Shah is the best professor for this course."*

- *"Best professor i have ever had. He goes above and beyond to make sure you are understanding material and cares about your learning journey. His class was very easy to understand and he was always available to help when needed."*
- *"Professor Shah is an excellent instructor. His method of teaching is very inclusive. He is always available to clear our doubts and keen to help. He never compromises on the quality of assignments either. This makes it really productive as one has a positive feeling to work."*
- *"Dr. Shah is a great professor. His teaching skill is amazing. As a PhD candidate, I learned a lots from him, the way he conducted his lecture and formed research problems associated with the class content, where all students can apply what they learn into their research areas. I also have chance to present my work and class-related topics and got many useful feedbacks from him. He is a great manner outside of the class too. I very appreciate his dedication."*
- *"Dr. Shah is a great teacher. He engages the class and is able to explain difficult concepts without losing the interest of the class. He answers emails within a day and is respectful to his students. Unlike many teachers, he seems to bring his full self to work. When he teaches, he is not "going through the motions." It is nice to have a professor that brings industry experience as well as computer science skills."*
- *"Absolutely the best professor I have had this semester. He asks for feedback and tweaks his teaching methods to cater to students. He understands the material may be tough for some and ensures there is enough information to fill gaps in knowledge."*
- *"Dr. Shah is one of the best professors I have had. He is very knowledgeable, and I am glad we had him for such an important class. He challenged us in very practical ways. We were exposed to real-life problems, which I think will be useful in the future. Dr. Shah was always available to help us and took his time to teach us Python. He adjusted the design of the class until he noticed it was of benefit for everyone. We were able to have hands on experience every class. We could definitely learn a lot every class. Please take care of this amazing professor! He is certainly a valuable asset for the Department."*
- *"Fantastic professor - he takes the extra time to re-explain any concept in class, provides useful feedback for all assignments, and reaches out to students who are struggling in the class on his own time. I wasn't doing well in the course at one point and I really appreciate that he took the time to reach out to me one-on-one and offer encouragement and help. My grade is much better now!"*
- *"It is a really good course for anyone willing to explore the world of DRL. Excellent design of the course coupled with the pedagogy. Dr. Shah always offered to help if students require it."*
- *"I have always enjoyed your teaching style. I really admire the time and effort you put not only on the class but also outside the class to help the students. I am looking forward for any new courses you will be offering in future (hopefully before I graduate)."*
- *"I'm pleased to be taught by Dr. Shah because I have gained a lot of skills in analytics such as numerical computing with Python in Google Colab, Data Vizulaztion, Nonlinear for K-nearest, and Neural Networks. I could not imagine I have gained the most important features in analytics in just three months. Dr. Shah cared about his students and make sure the students learn the material and how analytics is important in our field and future jobs.*

Again I'm really honored that Dr. Shah taught me analytics, and I wish Dr. Shah teaches more than one class in our undergraduate classes."

Ph.D. Committees (at USF):

- Major professor for the following Ph.D. students (graduated):
    - Soumyadeep Hore and Jalal Ghadermazi
- Co-major professor for the following Ph.D. students:
    - Mohammad Noroozi, Dinesh Sharma, and Ahtesham Bakht
- Dissertation committee member for the following students (graduated):
    - Vahid Mahmoodian (Industrial Engineering), Aigerim Bogyrbayeva (Industrial Engineering), Hasan Symum (Industrial Engineering), Hanisha Tatapudi (Industrial Engineering), Almuthanna Nassar (Electrical Engineering), Jinghan Meng (Computer Science and Engineering), Runan Yang (Civil and Environmental Engineering), Qianwen Li (Civil and Environmental Engineering), Salman Shuvo (Electrical Engineering), Zixiang Nie (Electrical Engineering), Animesh Nighojkar (Computer Science and Engineering), Sasan Mahmoudinazlou (Industrial Engineering), Quoc Nguyen (Industrial Engineering), and Diwas Paudel (Industrial Engineering)
- Dissertation committee member for the following students:
    - Guojun Liu (Computer Science and Engineering), Fadlullah Raji (Computer Science and Engineering), Donald Mccleeary (Mechanical Engineering), Purvee Bhatia (Mechanical Engineering), Zaid Marji (Computer Science and Engineering), Ahmed Shahabaz (Computer Science and Engineering), and Abhay Sobhanan (Industrial Engineering)

Service Contributions

To the Profession and Community:

- Organizing Committee Member, Workshop on Artificial Intelligence for Cyber Security (AICS), AAAI 2024, Vancouver, BC, Canada, 2024
- Program Committee Member, International Joint Conference on Artificial Intelligence (IJCAI-24), Jeju, South Korea, 2024
- Organizing Committee Member, INFORMS Conference on Security, Arlington, VA, 2024
- Workshop Chair, AI/ML for Cybersecurity, IEEE Conference on Dependable and Secure Computing, Tampa, FL 2023
- Session Chair, Cybersecurity Analytics, Military and Security Society, INFORMS Annual Meeting 2023
- Chair, Cybersecurity Cluster, INFORMS Annual Meeting 2022
- Session Co-Chair, AI for Cybersecurity, INFORMS Annual Meeting 2022
- Session Chair, Data Analytics and Simulation, INFORMS Annual Meeting 2021

- Session Co-Chair, Simulation and Reinforcement Learning, INFORMS Annual Meeting 2021
- Program Committee Member, ACM KDD 2021 Workshop on Artificial Intelligence-enabled Cybersecurity Analytics
- Publicity Chair, International Conference on Secure Knowledge Management in the Artificial Intelligence Era 2021
- Chair, Committee's Choice Cybersecurity Cluster, INFORMS Annual Meeting 2020
- Session Chair, Cybersecurity Analytics, INFORMS Annual Meeting 2020
- Program Committee Member, IEEE International Conference on Intelligence and Security Informatics 2020
- Program Committee Member, IEEE ICDM Workshop on Deep Learning for Cyber Threat Intelligence 2020
- Program Committee Member, Military Applications and Homeland Security Track at the Winter Simulation Conference, 2019-2023
- Judge, Doctoral Colloquium Poster Pitch Competition, 2020 IISE Annual Conference 2020
- Reviewer for the following Journals: IEEE Transactions on Dependable and Secure Computing (TDSC), ACM Transactions on Privacy and Security (TOPS), IEEE Transactions on Information Forensics and Security (TIFS), ACM Transactions on Management Information Systems (TMIS), Springer Soft Computing, and Springer Optimization Letters, among others

To the Department of Industrial and Management Systems Engineering at USF:

- Served as a Faculty Advisor for the IISE Student Chapter at USF, Fall 2020-Summer 2024
  - Received Gold Chapter Awards for 2020-2021 and 2021-2022
- Served as a Faculty Advisor for a team of undergraduate and graduate students in the Industry Consortium for the Raymond James project on Robotic Process Automation, 2019-2020 and 2020-2021
  - Received the Best Consortium Project Award for 2020-2021
- Served as a Faculty Search Committee Member, 2021 and 2023

Media Coverage

- USF Research and Innovation recognizes contributions to the research and development of AI-enabled decision-support methodologies in defense and civilian applications.
  - 2022: https://www.usf.edu/research-innovation/news/2022/outstanding-research-achievement-awards.aspx
  - 2023: https://www.usf.edu/engineering/news/2023/industrial-management/shah-research-award.aspx
- The USF Technology Transfer Office featured AI-enabled technologies for threat detection and mitigation. https://lnkd.in/e-sTwmBe

- INFORMS highlights AI and Optimization research work and its impact on Cybersecurity for government policymakers. https://www.informs.org/Impact/O.R.-Analytics-for-Government-Officials/Information-on-Artificial-Intelligence/Case-Studies
- U.S. Army press report highlights the research work on adversarial reinforcement learning for robust screening of cyberattacks. https://www.army.mil/article/237443
- ACM designates the paper on adversarial evaluation of a cyber alert inspection system using reinforcement learning as highly relevant to developers and engineers (Papers for Practitioners). https://www.acm.org/publications/papers-for-practitioners