

Umair Ahmad Mughal

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Educational Background

Ph.D. in Computer Science and Engineering Tennessee Technological University, Expected July 2024	2021-to date Tennessee, USA
Master of Science in Electrical and Computer Engineering INHA University	2020 Incheon, South Korea
Bachelor of Science in Electrical Engineering University of Engineering and Technology	2015 Peshawar, Pakistan

Research Interests

- Intersection of Cybersecurity, machine learning, and Data Science
- Deep Machine learning for data and security enhancement
- Cellular Vehicle-to-Everything (C-V2X) Technology

Professional Experience

Graduate Research Assistant <i>Cybersecurity Education, Research and Outreach Centre (CEROC)</i>	2021-to date Tennessee, USA
<ul style="list-style-type: none">▪ Penetration testing on an actual drone system by executing False data injection, Replay, Evil Twin, and DoS attacks to identify the critical attack vectors.▪ Designed and built a robust intrusion detection system using Graph Neural Network, CNN, LSTM, FNN, SVM, Random Forest, and sequential and ensemble algorithms such as bagging, boosting, and stacking.▪ Collected data from the actual drone swarm system under cyberattacks and normal operations. Preprocessed the raw data, performed fusion of different data sources, and open sourced this dataset on IEEE DataPort.▪ Identification of applications security vulnerabilities such as cross-site scripting, SQL injection, and DDoS attacks.	
Research Scientist <i>Oceanic IT Convergence Research Centre</i>	2020-2021 Asan, South Korea
<ul style="list-style-type: none">▪ Data analysis of underwater acoustic communication using machine learning for link adaptation and throughput.▪ Collected underwater acoustic data in the Incheon Sea over 1km and 3km distances between Tx and Rx.▪ Designed algorithms for autonomous underwater vehicle's (AUV) and embedded them to the AUV.	
Graduate Research Assistant <i>Mobile Telecommunication Research Laboratory</i>	2018-2020 Incheon, South Korea
<ul style="list-style-type: none">▪ Developed cellular vehicle-to-everything (C-V2X) software simulator according to 3GPP Rel. 14 & 15.▪ Published scholarly articles and worked on projects with Ministry of science, Korea.▪ Worked on 5G-V2X Side-link & PC5 Interface (V2V, V2I), and DSRC communication in vehicular environments.▪ Simultaneous Localization and Mapping (SLAM) technology for UAVs and published work on it.	
Junior Operation Engineer <i>Master Tiles & Ceramic Industries Limited</i>	2015-2017 Pakistan
<ul style="list-style-type: none">▪ Ladder Logic programming for PLC designing for Ceramic Plant operation.▪ Worked closely in operation for overall control system.	
BSS Intern Engineer Alcatel-Lucent Ltd.	June 2014 - September 2014 Pakistan
<ul style="list-style-type: none">▪ Worked at BSS-CMPak project in Operation and Maintenance department.▪ Implements modifications for the BTS sites.	

Certifications

- Penetration Testing, Incident Response and Forensics, IBM Cybersecurity Analyst Professional Certificate (Coursera)
- Security Risks in AI and Machine Learning: Categorizing Attacks and Failure Modes (LinkedIn)
- Cisco Networking Foundations: Wireless Networks, Services, Security, and Virtualization (LinkedIn)
- Software Development for Unmanned System, Drone Programming (Udemy)
- Generative AI with Large Language Models (Coursera)
- GPT-4 Foundations: Building AI-powered Apps (LinkedIn)
- LangChain for LLM Application Development (Deeplearning.ai)

Skills

- **Tools/software:** MATLAB, Keras, TensorFlow, Scikit-learn, Pandas, Scapy, Docker, Git, Aircrack-ng, Nmap, Wireshark, Metasploit, kali linux, Jupyter notebook, VS Code, VS studio, Ardupilot, Arduino, and Q-Groundcontrol.
- **Programming Languages:** Proficient in Python, Assembly, Shell Scripting, Java, and C/C++.
- **Cybersecurity Practices:** Threat Modeling, Intrusion Analysis, Penetration Testing, Forensics, Identity and Access Management (IAM), Cloud Security, and Malware Analysis.

Honors and Awards

- Awarded with travel fund from Centre for Energy Systems Research (CESR), Tennessee Tech University, 2023
- Awarded with travel fund from College of Engineering, Tennessee Tech University, 2023
- Recipient of the Jungseok International Scholarship to pursue M.S. Studies at Inha University, Korea.
- Awarded with Fully funded Undergraduate Studies from Provincial Govt., under the KPK Govt. Talent Hunt Programs.
- Awarded with Laptop for best performance from the Provincial Chief Minister KPK, Ameer Haider Khan Hoti.
- Member Pakistan Engineering Council, Accreditation No. ELECT/52138.

Professional Services

Reviewer

- Reviewer, Vehicular Communication, Elsevier Journal
- Reviewer, IEEE Networking Letters
- Reviewer, IEEE Internet of Things (IoT) Journal & Magazine (IoTM)

Other Services

- **AI-Assisted Cybersecurity competition** organization and Leading Graduate and Undergraduate teams. 2024 – Present
- Vice President of the Computer Science Graduate Student Club, Tennessee Tech University. 2022 – Present
- Ambassador for the International Graduate Students, Inha University. South Korea, 2020

Publications

International Journal

1. **U. A. Mughal**, R. Atat and M. Ismail, " Next-Gen Defense: an Architecture-Independent Sequential Ensemble Learning for Intrusion Detection in a Swarm of UAVs", in *IEEE Transactions on Intelligent Transportations Systems* (2024). ([Under Review](#))
2. I. Ahmad, R. Narmeen, **U. A. Mughal**, and K. H. Chang, " Optimizing Cell Association and Stability in Integrated Aerial-to-Ground Next-Generation Consumer Wireless Networks," in *IEEE Transactions on Consumer Electronics* (2024). ([Under Review](#))
3. **U. A. Mughal**, Y. Alkhrijah, A. Almadhor, C. Yuen, " Deep Learning for Secure UAV-Assisted RIS Communication Networks", *Internet of Thing Magazine* (2024). [Link](#) ([Code](#))
4. S. C. Hassler, **U. A. Mughal**, and M. Ismail, "Cyber-Physical Intrusion Detection System for Unmanned Aerial Vehicles", in *IEEE Transactions on Intelligent Transportation Systems* (2023). [Link](#) (IF= 8.5) ([code](#))
5. **U. A. Mughal**, J. Xiao, I. Ahmad, and K. H. Chang, "Cooperative Resource Management for Cellular V2I Communications in a Dense Urban Environment", in Elsevier *Vehicular Communications* 26 (2020): 100282. [Link](#) (IF=6.7) ([code](#))
6. R. Narmeen, I. Ahmad, Z. Kaleem, **U. A. Mughal**, "Shortest Propagation Delay-Based Relay Selection for Underwater Acoustic Sensor Networks", in *IEEE Access*, vol. 9, pp. 37923-37935 (2021). [Link](#) (IF= 3.9)
7. **U. A. Mughal** and K. H. Chang, "UAVs path planning by particle swarm optimization based on visual-SLAM algorithm", In *Intelligent Unmanned Air Vehicles Communications for Public Safety Networks*, pp. 169-197., *Springer Nature*, 2022. [Link](#) ([code](#))

Peer-Reviewed Conferences

8. **U. A. Mughal**, I. Ahmad, and C. Yuen, "Ensemble Learning-Based Intrusion Detection System for RIS-Assisted V2X Communication", *2024 IEEE 99th Vehicular Technology Conference (VTC2024-Spring)*, Singapore. ([Under Review](#)) ([Soon on github](#))
9. **U. A. Mughal**, M. Ismail and S. A. A. Rizvi, "Stealthy False Data Injection Attack on Unmanned Aerial Vehicles with Partial Knowledge", *2023 IEEE Conference on Communications and Network Security (CNS)*, Orlando, FL, USA, 2023, pp.1-9. [Link](#) ([code](#))
10. **U. A. Mughal**, S. C. Hassler and M. Ismail, "Machine Learning-Based Intrusion Detection for Swarm of Unmanned Aerial Vehicles", *2023 IEEE Conference on Communications and Network Security (CNS)*, Orlando, FL, USA, 2023, pp. 1-9. [Link](#) ([code](#))
11. Nafis Ahmad, **U. A. Mughal**, and KyungHi Chang, "3D Path Planning of Unmanned Aerial Vehicles", in *Proc. KICS*, Feb. 2020. [Link](#)
12. **U. A. Mughal**, I. Ahmad, and K. H. Chang, "Cellular V2X communications in unlicensed spectrum: Compatible coexistence with VANET in 5G systems", in *Proc. JCCI 2019: 29th Joint Communication and Information Conference*, May 2019. [Link](#)
13. **U. A. Mughal**, I. Ahmad, and K.H. Chang, "Virtual cells operation for 5G V2X communications", in *Proc. KICS*, Feb. 2019. [Link](#)

Software and Simulator

- **Developed C-V2X Simulator and delivers to Korea's MSIT (Ministry of Science, Information, and Technology)** Performance Analysis System Level Simulator in LTE-V2X Network Environment", *INHA University Industry-Academia Cooperation Foundation*, Program No. C-2019-024785, 2019-09-05. ([simulator code](#))
- **Developed Link Adaptation Simulator and handed over to the Oceanic IT Convergence Research Centre, Korea** System Level Simulator for Link-Adaptation for Next-Generation Underwater Acoustic Communications Networks. ([simulator code](#))
- **Developed Dataset executing cyber-attacks on an actual drone system and published it open sourced.** Cyber-Physical Dataset for UAVs Under Normal Operations and Cyber-attacks [[Download on IEEE DataPort](#)] ([github](#))