

Mohamed Elmahallawy

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EDUCATION

Missouri University of Science and Technology

Rolla, MO, USA

Ph.D. in Computer Science

Jan. 2022 - Feb. 2024

Dissertation: “Secure and Privacy-Preserving Federated Learning with Rapid Convergence in LEO Satellite Networks” GPA: 4.0/4.0

University of Rostock

Rostock, MV, Germany

M.Sc. Computer Science and Electrical Engineering

Oct. 2017 - May. 2019

Dissertation: “Utilizing Structural Information of Pareto-Front Management Techniques to Enhance Design Space Exploration” GPA: 3.2/4.0

Benha University

Benha, Egypt

M.Sc. Electrical and Computer Engineering

Sep. 2014 - Aug. 2017

Dissertation: “Study the Performance and coding Schemes for Underwater Acoustic Communication Systems” GPA: 3.73/4.0

Higher Institute of Engineering in Elshorouk City

Cairo, Egypt

B.Sc. Electronics and Communications Engineering

Sep. 2007 – Jul. 2012

Dissertation: “Developing a Control System for Autonomous Vehicles” (**first** student with honors) GPA: 3.94/4.0

PROFESSIONAL EXPERIENCE

Missouri University of Science and Technology

Rolla, MO, USA

Post Doctoral Fellow, Dept. of Computer Science

Mar. 2024 – Present

Duties & Responsibilities:

- Conducting research on developing a global ML approach for underground mines to enhance miners' safety while preserving the collected data privacy, and exploring secure navigation in GPS-denied environments.
- Providing mentorship for 5 Ph.D. students.

Missouri University of Science and Technology

Rolla, MO, USA

Graduate Research Assistant, Dept. of Computer Science

Jan. 2022 – Feb 2024

Duties & Responsibilities:

- Conducting research across various projects at the TrustAIoT lab, primarily focused on developing a secure and efficient federated learning model for low Earth orbit (LEO) satellite networks.
- Providing mentorship to undergraduate, M.Sc., and junior Ph.D. students.

Tennessee Technological University

Cookeville, TN, USA

Research Assistant, Dept. of Electrical and Computer Engineering

Jul. 2021 – Dec. 2021

Duties & Responsibilities:

- Conducting research on the use of machine learning to estimate the lifespan of Li-Ion batteries in electric vehicles (EVs), and optimizing battery performance to extend its life.
- Teaching Assistance for the Undergraduate Courses.

Courses taught:

Programmable Logic Controller Laboratory (Fall 2021)

Higher Institute of Engineering in Elshorouk City

Teaching Assistant, Dept. of Electronics and Communication Engineering

Cairo, Egypt

Jan. 2014 – Aug. 2017

Duties & Responsibilities:

- Taught undergraduate-level classes, wrote supplementary lecture notes, coordinated exams, and co-supervised graduation projects.

Courses taught:

Analysis of Algorithms and Introduction to Cybersecurity (Fall 2014, 2016, 2017, and 2018)

Communication Systems and Digital Signal Processing (Spring 2015, 2017, 2018)

Electronic Circuits (2) and Network and System Analysis (Spring 2014, 2016)

Electromagnetic Waves and Computer Programming Languages (Fall 2015)

RESEARCH AREAS

- Federated Learning for various Applications:

- LEO Satellite Constellations
- Medical Applications

- Trustworthy Artificial Intelligence and Internet of Things (Explainable and Interpretable AI)

- Cybersecurity in Machine/Federated Learning:

- Ensuring Privacy Preservation of Clients' Data in Federated Learning.
- Adversarial Machine Learning.

TEACHING INTERESTS

- I am knowledgeable about a variety of topics in computer science, computer engineering, communication engineering, and information science.

- I can teach a variety of undergraduate courses, such as Machine/Deep Learning, Data Mining, Cryptography and Network Security, Natural Language Processing, Data Structure, Communication Networks, Computer Programming, Computer Architecture, Logic Circuits, Communication Systems, and Digital Signal Processing.

- I can develop and teach new postgraduate courses:

- Machine Learning in Cyber security. It can cover the following topics:
 - Secure and Efficient Federated Learning
 - Adversarial Machine Learning
 - Privacy-preserving Evaluation of Machine Learning Models
 - Using Machine Learning to Launch Attacks and Counter Security Threat
- Applications of Internet of Remote Things (IoRT) Technology
- Advanced Cryptography Applications in Emerging Wireless Networks

PUBLICATIONS**Journal Papers**

[J1] **M. Elmahallawy** and T. Luo, "Secure and Privacy-Preserving Federated Learning for Low Earth Orbit Satellite Networks", *IEEE Transactions on Dependable and Secure Computing*, Under review.

[J2] **M. Elmahallawy**, T. Luo, and K. Ramadan, "Efficient Federated Learning for LEO Satellite Constellations Integrated with Unmanned High-altitude Platforms using hybrid NOMA-OFDMA", *IEEE Journal on Selected Areas in Communications (JSAC)*, 2024, DOI: 10.1109/JSAC.2024.3365885.

[J3] **M. Elmahallawy**, T. Elfouly, A. Alouani, and A. M. Massoud, "A Comprehensive Review of Lithium-Ion Batteries Modeling, and State of Health and Remaining Useful Lifetime Prediction", in *IEEE Access*, vol. 10, pp. 119040-119070, 2022.

[J4] **M. Elmahallawy**, A. TagEldein, and S. Elagooz, "Performance Enhancement of Underwater Acoustic OFDM Communication Systems", *Wireless Personal Communications* 108 (2019): 2047-2057.

[J5] **M. Elmahallawy** and A. TagEldein, "Performance Enhancement of UWA-OFDM Communication Systems based on FWHT", *International Journal of Communication Systems* 32.16 (2019): e3979.

Conference Papers

[C1] **M. Elmahallawy**, and Sanjay Madria, "FedMining: Distributed privacy-preserving Federated Learning for Enhancing Safety Monitoring in Longwall Coal Mining", The 43rd International Symposium on Reliable Distributed Systems (SRDS 2024), under review.

[C2] Md Sazedur Rahman, **M. Elmahallawy**, Sanjay Madria, and Samuel Frimpong, "CAV-AD: A Robust Framework for Detection of Anomalous Data and Malicious Sensors in CAV Networks", The 21st IEEE International Conference on Mobile Ad-Hoc and Smart Systems (MASS 2024), under review.

[C3] Manish Yadav, **M. Elmahallawy**, Sanjay Madria, and Samuel Frimpong, "Predicting Battery Levels in WSNs Using Reinforcement Learning in Harsh Underground Mining Environments", The International Conference on Embedded Wireless Systems and Networks (EWSN), under review.

[C4] Mizanur Jewel, **M. Elmahallawy**, Sanjay Madria, and Samuel Frimpong, "Enhanced Instance Segmentation for Low Visibility Environments in Underground Mines", IEEE International Conference on Data Mining (ICDM), under review.

[C5] Shreen Gul, **M. Elmahallawy**, and Sanjay Madria, "LPLgrad: Active Learning with Gradient Norm-Based Sample Selection and Enhanced Model Training", IEEE International Conference on Data Mining (ICDM), under review.

[C6] **M. Elmahallawy**, and T. Luo, "Secure Aggregation Is Myopic: Preserving Long-Term Privacy in Asynchronous Federated Satellite Learning", The 27 European Conference on Artificial Intelligence (ECAI), under review.

[C7] **M. Elmahallawy**, and T. Luo, "Stitching Satellites to the Edge: Pervasive and Efficient Federated LEO Satellite Learning", *22nd IEEE International Conference on Pervasive Computing and Communications (PerCom)*, March 2024.

[C8] **M. Elmahallawy**, T. Luo, and M. I. Ibrahim, "Secure and Efficient Federated Learning in LEO Constellations using Decentralized Key Generation and On-Orbit Model Aggregation", *IEEE Global Communication Conference (GlobeCom)*, December 2023.

[C9] **M. Elmahallawy**, and T. Luo, "One-Shot Federated Learning for LEO Constellations that Reduces Convergence Time from Days to 90 Minutes", *24th IEEE International Conference on Mobile Data Management (MDM)*, July 2023.

[C10] **M. Elmahallawy**, and T. Luo, "Optimizing Federated Learning in LEO Satellite Constellations via Intra-Plane Model Propagation and Sink Satellite Scheduling", *IEEE Conference on Communications (ICC)*, 2023.

[C11] **M. Elmahallawy**, and T. Luo, "AsyncFLEO: Asynchronous Federated Learning for LEO Satellite Constellations with High-Altitude Platforms", *2022 IEEE International Conference on Big Data (Big Data)*, Osaka, Japan, 2022, pp. 5478-5487.

[C12] **M. Elmahallawy**, and T. Luo, “FedHAP: Fast Federated Learning for LEO Constellations Using Collaborative HAPs”, in *Proc. IEEE 14th International Conference on Wireless Communication and Signal Process.*, Nanjing, China, 2022, pp. 1-6.

[C13] Yasmine Mustafa, **M. Elmahallawy**, T. Luo, and Seif Eldawlatly “A Brain-Computer Interface Augmented Reality Framework with Auto-Adaptive SSVEP Recognition”, IEEE International Conference on Metrology for eXtended Reality, Artificial Intelligence and Neural Engineering (MetroXRINE), 2023.

SERVICES & ACTIVITIES

- Reviewer for several leading Journals and Conferences:

- IEEE Journal on selected Areas in Communication (JSAC)
- IEEE Transactions on Industrial Informatics (TII)
- IEEE Access
- Springer, Peer-to-Peer Networking and Applications Journal
- IEEE International Conference on Communications (ICC)

- Attending several conferences:

- IEEE Conference on Pervasive Computing and Communications (PerCom) (Biarritz, France), 2024
- IEEE Global Communication Conference (GlobeCom), (Kuala Lumpur, Malaysia), 2023
- IEEE International Conference on Mobile Data Management (MDM), (Singapore), 2023
- IEEE International Conference on Communications (ICC), (Rome, Italy), 2023
- IEEE International Conference on Big Data (BigData), (Osaka, Japan), 2022
- The 14th IEEE International Conference on Communications and Signal Processing, (Nanjing, China), 2022
- The 11th IEEE International Conference on Computer Engineering & Systems, (Cairo, Egypt), 2016

HONORS & AWARDS

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|---|-----------|
| Dean's Scholar Award , Missouri University of Science and Technology, USA | Apr. 2024 |
| Best Paper Runner Up Award , IEEE Conference on Pervasive Computing and Communications | Mar. 2024 |
| NSF Student Travel Award , IEEE Conference on Pervasive Computing and Communications | Feb. 2024 |
| NSF Student Travel Award , IEEE Global Communication Conference (GlobeCom) | Dec. 2023 |
| 3MT Final List Competition Award , Missouri University of Science and Technology, USA | Nov. 2023 |
| NSF Student Travel Award , IEEE International Conference on Communications (ICC) | May. 2023 |
| 3MT Final List Competition Award , Missouri University of Science and Technology, USA | Nov. 2022 |
| Ph.D. Scholarship , Missouri University of Science and Technology, USA | Jan. 2022 |
| Research Assistant Fellowship , Tennessee Technological University, USA | Jul. 2021 |
| Best Teaching Award , The Higher Institute of Engineering in Elshorouk, Egypt | Aug. 2017 |
| M.Sc. Scholarship , University of Rostock, Germany | Oct. 2017 |
| Excellent Student Award , The Higher Institute of Engineering in Elshorouk City, Egypt | Sep. 2012 |
| B.Sc. Scholarship , The Higher Institute of Engineering in Elshorouk City, Egypt | 2007-2012 |

PROFESSIONAL REFERENCES

1. Tony Tie Luo, Associate Professor

Department of Computer Science, Missouri University of Science and Technology, Rolla, Mo 65401, USA.

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Homepage: <https://tluocs.github.io/> [\[Google scholar\]](#)

Relation: Ph.D. Supervisor

2. Tarek Elfouly, Associate Professor

Department of Electrical and Computer Engineering, Tennessee Technological University, Cookeville, TN 38501, USA.

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Relation: Research Collaborator

3. Mostafa Fouda, Associate Professor

Department of Electrical and Computer Engineering, and Department of Computer Science (joint appointment), College of Science and Engineering, Idaho State University, Pocatello, ID 83209, USA.

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Email: mfouda@isu.edu

Homepage: [\[Google scholar\]](#)

Relation: Research Collaborator