Seyed Soheil Johari

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EDUCATION

Ph.D. in Computer Science, *University of Waterloo* **Jan. 2021 — Present**

- Advisor: Prof. Raouf Boutaba
- Cumulative GPA: 94.1/100

B.Sc. in Electrical Engineering, *Sharif University of Technology* **Sep. 2015 — Sep. 2020**

- Advisor: Prof. Saber Salehkaleybar
- Cumulative GPA: 18.30/20

SKILLS

Machine Learning	Applied Machine Learning for Network Management, Anomaly Detection, Root Cause Analysis, Data-Driven Fault Diagnosis, Deep Learning, Reinforcement Learning, Active Learning, Causal Inference, Domain Adaptation, Adversarial Learning, Generative AI, Graph Analysis, Geometric Deep Learning.
Programming	Python, PyTorch, PyTorch Geometric, TensorFlow, Pandas, Git, LaTeX, MATLAB, VHDL, Verilog, C++, Java.
Networking	Linux Networking, NS3, ONOS, OpenStack, Kubernetes, Docker.
Personal	Problem Solving, Multitasking, Adaptability, Self-motivation, Time management, Communication, Research skills, Intercultural collaboration, Creativity, Attention to details, Decision making, Project management

TECHNICAL EXPERIENCE

5G-ELITE: AI-driven 5G Network Slice Operations and Management (in partnership with Rogers Communications)
University of Waterloo **January 2021 — Present**

- Project page: https://rboutaba-cs.github.io/wat5gslicing/
- As a PhD student at the University of Waterloo, I am part of a research team collaborating with Rogers Communications on a 5G network automation project, with a focus on fault management. My contributions involve automating the detection, analysis, and resolution of faults in 5G network slices, leveraging AI and machine learning techniques. I am engaged in various stages of the network slice life-cycle, including slice instantiation, configuration, and real-time monitoring, ensuring that the stringent quality of service (QoS) requirements of 5G are met. The project aims to develop a fully automated, data-driven approach to 5G network management, addressing key challenges in fault and performance management for next-generation networks.

Root Cause Analysis of Failures in Microservice Systems Using Incremental Causal Graph Learning
University of Waterloo **August 2024 — Present**

- This research focuses on root cause analysis (RCA), a task that identifies the root causes of system faults or failures by analyzing system monitoring data. The primary methods for RCA are based on causal discovery. We utilize incremental learning for causal inference-based RCA in microservice systems to enable real-time analysis. Unlike traditional methods that build a complete causal graph for each failure, we leverage advancements in continual learning to update an initially constructed causal graph (developed offline) during the system's normal operation. When a failure occurs, the modified graph allows for efficient RCA by reducing computational complexity, enabling root cause identification in real-time while maintaining accuracy. This approach significantly improves the speed and practicality of RCA in dynamic, complex systems.

Few-Shot Domain Adaptation for Effective Data Drift Mitigation in Network Management (Submitted to INFOCOM 2025)
University of Waterloo   September 2023 — July 2024

- This research presents our novel domain adaptation method to address data drift in 5G networks, particularly in few-shot scenarios where limited target domain data is available. We employ causal inference to separate domain-variant and domain-invariant features, focusing on the domain-invariant ones to enhance model robustness across different network conditions. Additionally, we introduce a Generative Adversarial Network-based technique to effectively leverage domain-variant features without causing cross-domain performance degradtion. Our approach shows a 43.9% improvement in mitigating data drift for network failure classification compared to state-of-the-art methods.

Active Learning for Transformer-Based Fault Diagnosis in 5G and Beyond Mobile Networks (Submitted to INFOCOM 2025)
University of Waterloo   September 2023 — July 2024

- This research presents our active learning (AL) framework tailored for Transformer-based fault diagnosis in 5G networks, addressing the challenge of limited labeled data. We reduce the need for large labeled datasets by selecting the most informative samples for labeling, leveraging the interpretability of Transformer models. Using attention weights, we create dependency graphs that represent data processing patterns and apply a one-class novelty detection approach to identify novel, unlabeled samples for expert annotation. Our experiments on real-world datasets demonstrate that our method achieves higher F1-scores than state-of-the-art AL algorithms with 50% fewer labeled samples and improves the identification of unseen fault types by up to 150%.

Anomaly Detection and Localization in NFV Systems by Utilizing Masked-Autoencoder and XAI (NOMS 2022 and TMC 2024)
University of Waterloo   January 2021 — November 2023

- This research presents our novel approach for anomaly detection and localization in Network Functions Virtualization (NFV) systems, which are critical to the resilience and performance of mobile edge and core networks. To address the limitations of unsupervised learning methods, particularly their vulnerability to contaminated training data, we introduce a technique based on the Noisy-Student framework. Our method uses a density-estimation teacher model to pseudo-label data and a Masked Autoencoder as a student model, improving robustness against contamination while enhancing anomaly detection accuracy. Additionally, we tackle anomaly localization by proposing a heuristic tailored to our detection model and two Explainable Artificial Intelligence (XAI)-based approaches that generalize to any detection model. Extensive experiments on multiple NFV datasets show that our methods outperform existing techniques, achieving up to 24% improvement in anomaly detection and 22% in anomaly localization, underscoring the effectiveness of our solution for NFV systems.

DRL-Assisted Reoptimization of Network Slice Embedding on EON-enabled Transport Networks (TNSM 2023)
University of Waterloo   January 2022 — January 2023

- This research presents our solution for re-optimizing network slice embedding in Elastic Optical Networks (EONs) to minimize spectrum fragmentation, a key challenge in 5G transport networks. We address the problem in its splittable version, which increases complexity but enables more re-configuration opportunities. To explore this large solution space, we employ simulated annealing and propose a greedy algorithm to reduce the number of re-configuration steps. Additionally, we introduce a Deep Reinforcement Learning (DRL)-based method to determine the optimal timing for re-configuration. Our simulations show that the greedy algorithm performs similarly to simulated annealing with significantly fewer re-configuration actions. Furthermore, applying the greedy algorithm periodically using the DRL-based timing method results in a substantial increase in the total number of accepted slice requests while limiting re-configuration operations.

B.Sc. Thesis
Sharif University of Technology   September 2018 — September 2020

- This research analyzes the long-term effects of two major fairness criteria in automated decision-making by modeling the problem as a Markov Decision Process (MDP). Given the large state space, we approximate the solution using Q-learning with a neural network (deep Q-Network). By comparing the impact of applying these fairness criteria to an unconstrained scenario, we show that more effective solutions exist for achieving optimal outcomes than using current fairness criteria.

PUBLICATIONS

- **S. S. Johari**, M. Tornatore, R. Boutaba, A. Saleh. "Few-Shot Domain Adaptation for Effective Data Drift Mitigation in Network Management." Submitted to *IEEE International Conference on Computer Communications (INFOCOM) 2025.* Under review.

- **S. S. Johari**, N. Shahriar, M. Tornatore, R. Boutaba, A. Saleh. "Active Learning for Transformer-Based Fault Diagnosis in 5G and Beyond Mobile Networks." Submitted to *IEEE International Conference on Computer Communications (INFOCOM) 2025.* Under review.

- **S. S. Johari**, N. Shahriar, M. Tornatore, R. Boutaba, A. Saleh. "Anomaly Detection and Localization in NFV Systems by Utilizing Masked-Autoencoder and XAI." Submitted to *IEEE Transactions on Mobile Computing (TMC).* Under review. [pdf]

- **S. S. Johari**, S. Taeb, N. Shahriar, S. R. Chowdhury, M. Tornatore, R. Boutaba, J. Meetra and M. Hemmati. "DRL-Assisted Reoptimization of Network Slice Embedding on EON-enabled Transport Networks." *IEEE Transactions on Network and Service Management (TNSM) 2023.* [pdf]

- **S. S. Johari**, N. Shahriar, M. Tornatore, R. Boutaba, A. Saleh. "Anomaly Detection and Localization in NFV Systems: An Unsupervised Learning Approach." *IEEE/IFIP Network Operations and Management Symposium (NOMS) 2022.* **Recipient of the Best Student Paper Award.** [pdf]

SELECTED COURSES AT UNIVERSITY OF WATERLOO

Advanced Network Architectures (92/100)	Network Softwarization (93/100)	Reinforcement Learning (95/100)
Deep Learning (96/100)	Graph Neural Networks (95/100)	Security in Machine Learning (95/100)

REVIEWING EXPERIENCE

- Reviewing four paper for *IEEE International Conference on Computer Communications (INFOCOM)*, 2022-2024.

- Reviewing three papers for *IEEE Transactions on Network and Service Management (TNSM)*, 2022-2024.

- Reviewing one papers for *IEEE Transactions on Mobile Computing (TMC)*, 2023.

- Reviewing one paper for *IEEE International Conference on Advanced Networks and Telecommunications Systems (ANTS)*, 2022.

TEACHING EXPERIENCE

Teaching Assistant for *Object-Oriented Software Development* (9 times)	University of Waterloo
Teaching Assistant for *Algorithm Design and Data Abstraction* (2021)	University of Waterloo
Teaching Assistant for *Intro to Machine Learning* (2019)	Sharif University of Technology
Teaching Assistant for *Computer Architecture* (2019)	Sharif University of Technology
Lab Assistant for *Java Programming Lab* (2018)	Sharif University of Technology

AWARDS AND HONORS

- **Best Student Paper Award**, IFIP/IEEE Network Operations and Management Symposium (NOMS) 2022, Budapest, Hungary

- **Student Travel Grant**, IFIP/IEEE Network Operations and Management Symposium (NOMS) 2022, Budapest, Hungary

- **PhD Entrance Award** of David Cheriton School of Computer Science, University of Waterloo

- Granted membership in the **National Elite Foundation** of Iran for five consecutive years

- Ranked **80th** among almost 400,000 participants in the Nationwide Iranian Universities Entrance Exam (Konkur) in the field of Mathematics and Physics, 2015