Qiong LIU

Chinese citizenship
French residency *(carte de séjour pluriannuelle)*

Enseignante-Chercheuse (Assistant Professor)
ETIS, CY Cergy Paris University
2 Av. Adolphe Chauvin, Pontoise, France
+33 7 81 37 76 88
qiong.liu@ensea.fr

Main Research Interests

- AI for Networked Systems
- Stochastic Modeling (incl. Geometry and Queues)
- Softwarized Infrastructures (NFV, SDN, MLOps)

Professional Experience

2024.09–present **Assistant Professor**
ETIS UMR 8051, CY Cergy Paris University — Cergy, France

- Responsibilities: 50% laboratory research and 50% teaching (192 required hours)

2022.10–2024.09 **Postdoctoral Researcher**
INFRES (Computer Science and Networks), Télécom Paris — Palaiseau, France

- Research theme: Artificial Intelligence applied to high-speed software networks

Academic Education

2018.11–2022.6 **Ph.D. in Telecommunications**
CNRS 6164, INSA Rennes — Rennes, France

- Thesis Title: Performance Analysis of Dynamic Downlink Cellular Networks
- Supervisors: Philippe Mary, Jean-Yves Baudais
- Jury of oral defense: L. Clavier (Chair), M. Di Renzo (Referee), L. Mroueh (Referee), M. Coupechoux

2015.09–2018.10 **M.Sc. in Telecommunication**
Xidian University — Xi'an, China

2011.09–2015.06 **B.Sc. in Electronic Information and Technology**
Shandong University — Shandong, China

Research Activities

2024.09–present **Assistant Professor**
ETIS UMR 8051, CYU, ENSEA, CNRS — Cergy, France

- **Operationalizing AI in high-speed softwarized networks**
  - We assess key challenges in the AI/ML lifecycle to enhance sustainability in softwarized networks, aiming to replace traditional one-shot ML approaches with a continuous, trigger-based system.
  - We develop an MLOps platform with components that facilitate performance prediction and anomaly detection in softwarized networks, enhancing both efficiency and reliability.
  - Collaborators: Nokia Bell Labs, Télécom Paris
- **Stochastic geometry-based MCS adaption modeling for cellular networks**
  - We studied the impact of Modulation and coding schemes (MCS) adaption in uplink networks with Poisson-distributed transceivers, utilizing stochastic geometry-based methodologies to evaluate network performance.
  - Currently extending previous work to constructe tractable mathematical models to analyze the efficacy of OMA, NOMA and RSMA in uplink networks considering MCS adaption.
  - Collaborators: Southeast University

- **In-network AI/ML for cybersecurity**
  - Botnet Analysis: We analyze real-world bot traffic traces and employ AI/ML techniques to pinpoint the most relevant features for botnet detection.
  - In-network AI/ML for botnet detection: We introduce In-network Caching Shelter (INCS), an in-network ML solution implemented on NVIDIA BlueField-2 Data Processing Units to realize in-network AI/ML for botnet detection.
  - Collaborators: University of Oxford, Nokia Bell Labs, Simula Research Laboratory

2022.10–2024.07 **PostDoc Researcher**
INFRES (Computer Sciences and Networks),
Télécom Paris — Palaiseau, France

- Work with Leonardo Linguaglossa, Tianzhu zhang
- **Applied AI/ML for high-speed softwarized networks**
  - Non-intrusive network measurement: Instead of directly collecting the packet- and flow-level features, we explore the low-level hardware features ubiquitously available in modern commodity hardware, such as the CPU cores, multi-level caches, memory subsystem, and PCIe buses, which have minimal impact on normal network operations.
  - Performance diagnosis: We develop predictive models to infer performance impairments and deduce the associated bottlenecks in high-speed NFV data plane.
  - Performance optimization: we implement a Deep Reinforcement Learning (DRL)-based framework to pinpoint resource contentions at runtime and automatically adjust the *Last-level Cache* allocation to optimize the end-to-end service performance, e.g., throughput, latency, and energy efficiency.
  - Collaborators: Nokia Bell Labs, Tsinghua University
- **Proactive VNF redeployment and traffic routing (VRTR)**
  - We apply an entropy measure to gauge the uncertainty in the substrate network.
  - We formulate the VRTR problem with a compact matrix representation, which can be efficiently solved, even in large-scale networks with high traffic loads.
  - We develop a proactive algorithm to cognitively update the service placement scheme, traffic routing rules, and redeployment interval.
  - Collaborators: Nokia Bell Labs, University of Bologna

2018.11–2022.6 **Ph.D. student**
IETR (Institut d'Electronique et des Technologies du numéRique) &
CNRS, INSA Rennes — Rennes, France

- Advised by Jean-Yves Baudais, Philippe Mary
- Our research employs stochastic geometry, queueing theory, and reinforcement learning algorithms to address coverage probability and stable regions of random networks.
  - We constructed tractable mathematical models to describe the coverage probability, queue delay, and packet loss probability, considering different application scenarios with infinite and finite buffers.
  - We characterized the ϵ-stable region, which is the set of arrival rates such that the proportion of unstable queues is not more significant than ϵ, in large-scale dynamic downlink cellular networks, with multi-cells and random link distances.
  - We explored transmission policies based on channel state information (CSI), queue states, and interference in dynamic downlink cellular networks. We modeled the problem using a Markov decision process (MDP) with an infinite horizon and infinite buffers, addressing it through online reinforcement learning to minimize transmission costs and reduce buffer delay at base stations.

TEACHING

- Total validated: 273 hours
- Academic Year 2024-2025 [CY Cergy Paris University] :
  - "Mobile Programming", Bachelor 3, [CM+ TP], total of 37.5h+37.5h
  - "Advanced Networks (Networks 2)", Master 2, [CM+ TP], total of 30h

- "Probability and Statistics for Signals and Networks", Master 1, [CM+ TD], total of 43.5h
- "Java and Object-Oriented Programming", Engineering 3, [CM+ TP], total of 70h

- Academic Year 2023-2024 [Télécom Paris] :
  - "Access and Scheduling", Engineering 3, [CM+ TP], total of 21h
  - "IP Networks", [TP], total of 6h
  - "TinyML - Research Initiation Project", Engineering 1, [Project], total of 22.5h

Mentoring

- (Co-)mentoring of Master interns and PhD student:
  - 2024.09–present, Lin Jianke, M1, "Towards MLOps - Design and Implementation of a Handwritten Digit Recognition Pipeline using Kubeflow and Kubernetes", CY Cergy Paris University, France
  - 2024.03–2024.09, Qiu Yuanyi, M2, "Towards MLOps: a Case study on ML Pipeline Platform", Télécom Paris, France
  - 2024.04–2024.06, Hippolyte Verninas, Eng3, "Design of a PPO-based RL algorithm", Télécom Paris, France
  - 2024.04–present, Guo Xinyi, phd student, "Stochastic Geometry-based MCS Adaptation modeling for Cellular Networks", Southeast University, China

Languages & Programming skills

Languages	Chinese: mother tongue, English: proficiency, French: intermediate
Programming	Python, Java, CPLEX + Gurobi (experienced), MATLAB, C, BASH
Frameworks	PyTorch, TensorFlow, Intel DPDK, Intel PCM, Kubernetes/Kubeflow, Android Studio

Participated projects

- 2023.02–2024.09 Participant of the "ANR" funding supported by the project IONOS-DX.
- 2023.02–2024.09 Participant of the "Beyond 5G" project supported by Digital Infrastructure Strategic Sector Committee.

Publications

Under revision

- **Q. Liu***, J. Lin, T. Zhang, L. Linguaglossa, "Non-Intrusive MLOps-Driven Performance Intelligence in Software Data Planes", submitted to Computer Networks.
- C. Zheng, **Q. Liu**, T. Zhang, M. Hemmatpour, and N. Zilberman, "Bontent Attacks from Birth to Grave - An In-network AI/ML Approach, to be submitted to IEEE Communications Magazine.

2025

- X. Guo, **Q. Liu***, S. Wang, L. You. "Stochastic geometry-based MCS adaption for uplink networks," 23th IEEE Wireless Communications and Networking Conference (WCNC).

2024

- **Q. Liu**, T. Zhang, M. Hemmatpour, *et al, "Operationalizing AI/ML in Future Networks: A Bird's Eye View from the System Perspective", IEEE Communications Magazine. [Impact Factor: 11.2, Q1]*
- **Q. Liu**, T. Zhang, L. Linguaglossa, "Non-invasive Performance Diagnosis of Virtual Network Functions with Limited Knowledge" *IEEE International Conference on Computer Communications (INFOCOM), 2024, Vancouver, Canada, pp. 1-10. [Acceptance 19%], [Rank: Q1].*
- **Q. Liu**, T. Zhang, Walter Cerroni, L. Linguaglossa "Proactive VNF Redeployment and Traffic Routing for Modern Telco Networks," accepted to *IEEE International Conference on Network Softwarization (Netsoft), 2024, pp. 1-9.[Acceptance 24%], [Best Paper Runner-up Award]*

2023

- **Q. Liu**, C. Wang, C. Zheng, "Distributed Decisions on Optimal Load Balancing in Loss Networks," *the 21th International Symposium on Modeling and Optimization in Mobile, Ad hoc, and Wireless Networks (Wiopt), 2023, Singapore, pp.1-8. [Acceptance 30%], [H-Index:20]*

2022

- **Q. Liu**, J. -Y. Baudais and P. Mary, "Transmission Policies Based on Learning by Reinforcement and Stochastic Geometry for Dynamic Cellular Networks," *the 29th Signal and Image Processing Research and Study Group (GRETSI) 2022, France, pp.1-4.*
- **Q. Liu**, J. -Y. Baudais and P. Mary, "Analysis of the Epsilon-stable Region in Dynamic Downlink Cellular Networks," *IEEE 94rd Vehicular Technology Conference (VTC), 2022, Helsinki, Finland, pp.1-6., [H-Index:127]*

2021

- C. Wang, **Q. Liu**,"Load Balancing Game in Loss Communication Networks," *the 20th Games, Agents, and Incentives Workshop (GAIW) in International Conference on Autonomous Agents and Multiagent Systems (AAMAS), 2021, London, England, pp.1-8*
- **Q. Liu**, J. -Y. Baudais and P. Mary, "Queue Analysis with Finite Buffer by Stochastic Geometry in Downlink Cellular Networks," *IEEE 93rd Vehicular Technology Conference (VTC), 2021, Helsinki, Finland, pp.1-5, [H-Index:127]*
- **Q. Liu**, J. -Y. Baudais and P. Mary, "A Tractable Coverage Analysis in Dynamic Downlink Cellular Networks, *IEEE 21st International Workshop on Signal Processing Advances in Wireless Communications (SPAWC), 2020, (virtual) USA, pp.1-6. , [H-Index:40]*

Scholarly Review Activities

- IEEE Communications Magazine, IEEE INFOCOM 2025, IEEE ICC 2025, IEEE SmartGridComm, 2024
- IEEE ICC 2024, IEEE CloudNet 2023, IEEE Globecom 2023
- IEEE Transactions on Wireless Communication, 2022
- ACM Transactions on Modeling and Performance Evaluation of Computing Systems, 2022

Seminar

- "Virtualization & AI: how to monitor, diagnose and optimize NFV/SDN-enabled networks with AI technologies?", Équipes Traitement de l'information et systèmes (ETIS), 04/06/2024, CY Cergy Paris University, France.
- "Coverage and Stability Analysis of Cellular Network with Temporal Traffic", Laboratory for information, networking and communication sciences (LINCS), 16/11/2022, Paris, France.