

Chuanchoao Gao

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🌐 Personal Website

🔍 Google Scholar

Research Interests

Approximation algorithms; combinatorial optimization; real-time scheduling; heterogeneous resource allocation; mobile edge and network-integrated systems; bridging theory and practice.

Education

Nanyang Technological University, Singapore

Aug 2021 – Jan 2026

Doctor of Philosophy (Ph.D.) in Computer Science and Engineering

Thesis: *Heterogeneous Resource Management for Real-Time Applications in Mobile Edge Computing*

Supervisor: Assoc. Prof. Arvind Easwaran

Oral defense completed; degree conferral pending

Nanyang Technological University, Singapore

Jan 2020 – Jul 2021

Graduate Studies in Computer Science and Engineering (completed M.Eng. coursework and research before transfer to Ph.D. program)

Research Topic: *Anomaly Detection for Digital Twin Integrated Cyber-Physical Systems*

Supervisor: Assoc. Prof. Arvind Easwaran

Nanyang Technological University, Singapore

Aug 2013 – Jul 2017

B.Eng. in Mechanical and Aerospace Engineering

Specialization: Robotics and Mechatronics

First Class Honours

Research Contributions

- Developed the first constant-factor approximation algorithms for multiple NP-hard deadline-constrained task offloading and resource allocation problems in mobile edge computing.
- Formulated heterogeneous real-time scheduling and offloading problems as generalized knapsack and matching variants, enabling provable performance guarantees beyond heuristic approaches.
- Designed and open-sourced a large-scale, packet-level mobile edge computing simulator (mecRT) to validate algorithmic guarantees under realistic 5G network dynamics and system failures.
- Bridged theoretical algorithm design with system-level evaluation, showing that provable guarantees can translate into measurable performance improvements in practical MEC settings.

Research Experience

Ph.D. Researcher, Nanyang Technological University

Aug 2021 – Present

- Conducting research on algorithmic foundations of heterogeneous resource management for real-time applications in mobile edge computing systems.
- Designed and open-sourced a mobile edge computing simulator (mecRT) enabling reproducible, large-scale evaluation of scheduling and resource allocation algorithms under realistic network and system constraints.
- Designed polynomial-time approximation algorithms with constant provable performance guarantees for multiple deadline-constrained task mapping and resource scheduling problems in MEC.
- Authored five peer-reviewed conference papers (RTSS×2, DATE, GLOBECOM, RTCSA) and three peer-reviewed workshop papers in leading IEEE/ACM venues.

Research Assistant, Nanyang Technological University

May 2020 – Jun 2021

- Designed fault detection mechanisms for large-scale cyber-physical systems by integrating anomaly detection with digital twin models to improve system observability and operational reliability.
- Published one peer-reviewed conference paper at ICCPS 2021.

Publications

Peer-reviewed Conference Papers

- **C. Gao** and Arvind Easwaran, “Real-Time Service Subscription and Adaptive Offloading Control in Vehicular Edge Computing”, IEEE Real-Time Systems Symposium (RTSS), 2025.
- **C. Gao** and Arvind Easwaran, “Energy-Efficient Joint Offloading and Resource Allocation for Deadline-Constrained Tasks in Multi-Access Edge Computing”, IEEE International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA), 2025.
- **C. Gao**, Niraj Kumar and Arvind Easwaran, “Energy-Efficient Real-Time Job Mapping and Resource Management in Mobile-Edge Computing”, IEEE Real-Time Systems Symposium (RTSS), 2024.
- Niraj Kumar, **C. Gao** and Arvind Easwaran, “Optimal Fixed Priority Scheduling in Multi-Stage Multi-Resource Distributed Real-Time Systems”, Design Automation and Test in Europe (DATE), 2024.
- **C. Gao**, Shaan Aryaman and Arvind Easwaran, “Deadline-constrained Multi-resource Task Mapping and Allocation for Edge-Cloud Systems”, IEEE Global Communications Conference (GLOBECOM), 2022.
- **C. Gao**, Heejong Park and Arvind Easwaran, “An Anomaly Detection Framework for Digital Twin Driven Cyber-Physical Systems”, IEEE/ACM International Conference on Cyber-Physical Systems (ICCPS), 2021

Peer-reviewed Workshop Papers

- **C. Gao** and Arvind Easwaran, “VecSim, a Vehicular Edge Computing Simulator for Real-Time Applications”, Demo Session of IEEE International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA), 2025.
- **C. Gao** and Arvind Easwaran, “Local Ratio based Real-time Job Offloading and Resource Allocation in Mobile Edge Computing”, Real-Time And IntelliGent Edge Computing Workshop (RAGE), 2025.
- **C. Gao** and Arvind Easwaran, “Work-in-Progress: Deadline-Constrained Multi-Resource Allocation in Edge-Cloud System”, Brief-Presentations Session of IEEE Real-Time Systems Symposium (RTSS), 2022.

Awards and Scholarships

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| • NTU Research Scholarship | Aug 2021– Aug 2025 |
| • NTU Science and Engineering Undergraduate Scholarship | Aug 2013 – Aug 2017 |

Teaching Experience

- Lab Supervisor, Operating Systems (Undergraduate Course), NTU, 2022
- Lab Supervisor, Algorithm Design & Analysis (Undergraduate Course), NTU, 2023
- Lab Supervisor, Embedded Programming (Undergraduate Course), NTU, 2023
- Supervisor, 7 Undergraduate Final-Year Projects on real-time scheduling and mobile edge computing, 2021–2025

Professional Experience

Equipment Engineer, United Microelectronics Corporation, Singapore

Jun 2017 – Jan 2020

Designed and deployed a real-time IoT-based monitoring system in a production manufacturing environment, improving system observability and operational reliability.

Professional Service

- Reviewer (under supervision of Prof. Arvind Easwaran) for 10+ journal and conference submissions, including IEEE Transactions on Cloud Computing, IEEE Transactions on Parallel and Distributed Systems, IEEE Transactions on Service Computing, IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, RTSS, ECRTS, and ICCPS.
- Web Chair, ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS) 2025

Technical Skills

Research: mathematical modeling, combinatorial optimization, approximation algorithms, MEC system design

Programming: Python, C++, MATLAB

Tools: OMNeT++, Simu5G, Docker, CPLEX, Gurobi