




# Jiaming Cheng

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## RESEARCH INTERESTS

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My research interests lie in optimization, machine learning, and operations research with a specific focus on developing mathematical models for decision-making and economic analysis of large-scale networked systems, including edge/cloud computing, energy systems, intelligent transportation, and the crowdfunding market. My research objective is to investigate and understand fundamental questions using both theoretical and practical approaches and provide useful insights into the design of systems and algorithms in practice.

**Keywords:** Optimization under uncertainty; Network economics; Applied operation research; Game theory.

## EDUCATION

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<b>University of British Columbia</b> <i>P.h.D in Electrical Engineering</i>	Sep 2021 - Present <i>GPA: 4.0/4.0</i>
<b>University of British Columbia</b> <i>M.A.S.c in Electrical Engineering</i>	Sep 2019 - Sep 2021 <i>GPA: 3.9/4.0</i>
<b>University of Alberta</b> <i>B.S.c in Electrical Engineering (with distinctions)</i>	Sep 2015 - April 2019 <i>GPA: 3.6/4.0</i>

## PROFESSIONAL EXPERIENCE

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<b>Data engineer (Intern)</b>   <i>Metro Vancouver, BC hydro</i>	Sep 2022 - Aug 2023
<ul style="list-style-type: none"><li>Used a surrogate model to disaggregate provincial level data provided by Environment and Climate Change Canada (ECCC) to compare bylaw data for different tier NREs from Metro-Vancouver.</li><li>Worked with stakeholders on EV charging infrastructure placement and capacity planning problems under both long-term uncertainty (e.g., demand growth) and short-term renewable energy uncertainty.</li></ul>	
<b>Research scientist (Intern)</b>   <i>Rogers Communication, Canada</i>	Jan 2020- April 2021
<ul style="list-style-type: none"><li>Utilize deep reinforcement learning (DRL) to derive an optimal bidding strategy for service providers by solving a bilevel problem with non-convex lower-level problems, which cannot be solved by KKT conditions. DRL is used to approximate the lower-level problem.</li><li>Utilize a two-stage robust optimization framework to tackle service placement and resource allocation under joint failure and demand uncertainties.</li></ul>	
<b>Power Engineer (Summer Intern)</b>   <i>Forschungscampus Flexible Elektrische Netze, Aachen</i>	May. 2018 - Sep. 2018
<ul style="list-style-type: none"><li>Worked on AC/DC power flow for distribution grid while considering renewable energy and battery storage.</li><li>Worked on joint pricing and resource allocation problems in the electricity market.</li></ul>	

## RESEARCH EXPERIENCE

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<b>Transdisciplinary PhD Pilot Program for Climate Emergency</b> [ <a href="#">Link</a> ]	Sep. 2022 - Aug. 2023
<ul style="list-style-type: none"><li>Worked with external stakeholders (Metro-Vancouver, BC hydro) on EV charging infrastructures planning and electrification for non-road equipment.</li><li>Quantitatively modeled the benefits of explicitly considering the equity and potential risks when formulating the optimization problem. (e.g., Alpha-fairness, max-min fairness, Conditional Value at risk (CVaR), Chance constraints, etc.)</li><li>Identified stakeholders' barriers and conflicts to support policy-making for regulatory sectors according to the quantitative analysis.</li></ul>	
<b>Edge Cloud Design and Sustainable Computing</b>   <i>Supervisor: Prof. Vijay Bhargava</i>	Sep. 2019 - Sep. 2021
<ul style="list-style-type: none"><li>Worked on service placement, task offloading, and resource management problems under uncertainties (e.g., Correlated demand uncertainty, failure uncertainty, decision-dependent uncertainty) in edge cloud computing.</li><li>Worked on data center operation with coordination of renewable energy system and energy storage system (e.g., battery) while considering energy trading options and uncertain wind speed.</li></ul>	
<b>Adaptive Ramp Metering Controller design</b>   <i>Supervisor: Prof. Jiming Chen</i>	June. 2019 - Sep. 2019

- Established a Spatial-temporal Graphical Neural Network (ST-GCN) to predict the traffic volume of unseen segments in the highway, and designed a dynamic congestion controller for each road segment based on predicted traffic to reduce the possibility of congestion in the main highway.
- Used direct radial basis function (RBF) neural network controller as a baseline model to predict the traffic volume in the main highway.

#### Energy Model Estimation for Electric buses | Supervisor: Prof. Hao Liang

Sep. 2018 - April. 2019

- Developed a data-driven approach to estimate the energy consumption model for electric buses that are deployed in St. Alberta.
- Considered a detailed physical model of electric buses to model its energy consumption considering the randomness factors, including speed, acceleration, and passenger count.
- Designed and implemented a portable and cheap data collection unit for electrical buses for long-term operation.

#### User Scheduling and Antenna Selection in MIMO | Supervisor: Prof. Yindi Jing

Sep. 2018 - April. 2019

- Simulated a downlink process in a single cell with *i.i.d* Rayleigh fading channels and zero-forced beamform precoding method under both perfect and imperfect CSI.
- Proposed an algorithm to select the best antenna set for users to approximate the maximum reachable sum rate by spatial selective gain.
- Presented a performance comparison (average per-user rate) and computational complexity obtained with the proposed algorithm and previous work.

## PUBLICATIONS

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### Journal:

[J1] **J. Cheng**, D.T. Nguyen, and V. K. Bhargava, “Resilient Edge Service Placement under Demand and Node Failure Uncertainties”, *IEEE Trans. Netw. Service Manag*, 2023 [[Arxiv](#)]

[J2] D.T.A. Nguyen, **J. Cheng**, Ni Trieu, and D.T. Nguyen, “A fairness-aware attacker-defender model for optimal edge network operation and protection”, *IEEE Networking letter*, 2023 [[Arxiv](#)]

### Conference:

[C1] **J. Cheng**, D.T.A. Nguyen, and D.T. Nguyen, “Two-stage distributionally robust edge node placement under endogenous demand uncertainty”, *IEEE INFOCOM*, Vancouver, 2024 [[Arxiv](#)]

[C2] D.T.A. Nguyen, **J. Cheng**, N. Trieu, and D.T. Nguyen, “Optimal Workload Allocation for Distributed Edge Clouds with Renewable Energy and Battery Storage”, *IEEE ICNC*, Big Island, Hawaii, 2024 [[Arxiv](#)] [[Code](#)]

[C3] D.T.A. Nguyen, **J. Cheng**, D.T. Nguyen, and A. Nedic, “CrowdCache: A decentralized game-theoretic framework for mobile edge content sharing”, 21st International Symposium on Modeling and Optimization in Mobile, Ad hoc, and Wireless Networks (*Wiopt*), Singapore, 2023 (**Best paper finalist**). [[Arxiv](#)] [[Code](#)]

[C4] **J. Cheng**, D.T.A. Nguyen, L. Wang, D.T. Nguyen, and V. K. Bhargava, “A bandit approach to online pricing for heterogeneous edge resource allocation”, *IEEE NetSoft*, Madrid, Spain, 2023. [[Arxiv](#)]

[C5] K. N. R. Surya Vara Prasad, **J. Cheng** and V. K. Bhargava, “Accurate distance estimation for RSS localization with statistical path loss exponent model”, *IEEE GLOBECOM*, Taipei, 2020. [[Paper](#)]

### Under preparation:

**J. Cheng**, D.T.A. Nguyen, Ni Trieu, and D.T. Nguyen, “Delay-aware robust edge network hardening under decision-dependent uncertainty“, under revision.

**J. Cheng**, D.T.A. Nguyen, and D.T. Nguyen, “Robust Dynamic Edge Service Placement Under Spatio-Temporal Correlated Demand Uncertainty“, under revision.

D.T.A. Nguyen, **J. Cheng**, L. Wang, and D.T. Nguyen, “Bandit with knapsacks for online heterogeneous edge resource pricing and allocation“, working paper.

D.T.A. Nguyen, **J. Cheng**, and D. T. Nguyen, “CrowdCache: A Decentralized Game-Theoretic Framework for Mobile Edge Content Sharing over Time-varying Communication Graph“, Working paper.

## SKILLS

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**Research skills:** (Robust) Combinatorial optimization, Two-stage (Multi) robust/stochastic optimization, Distributionally robust optimization, distributed optimization, Bandit learning, (Deep) reinforcement learning, online optimization, Physical-informed neural network (PINN), Bilevel optimization (e.g., meta-learning, Stackelberg game), Non-cooperative game.  
**Languages:** C/C++, Python, MySQL, HTML/CSS, L<sup>A</sup>T<sub>E</sub>X, Julia  
**Mathematical programming:** CPLEX, JuMP, PuLP, Pyomo, Gurobipy, CVXPY, CVX  
**Solvers:** CPLEX, MOSEK, Gurobipy, YAMLP, Ipopt  
**Libraries:** Pandas, NumPy, PyTorch, TensorFlow, Keras, Scipy, SkLearn  
**Tools:** Git/GitHub, Unix Shell

## SUPERVISORY & TEACHING ASSISTANT

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<b>REX mentor in undergraduate research organization</b>   <i>Mentor</i> Supervise undergraduate research	May. 2023 - Present
<b>Capstone project supervisor</b>   <i>Instructor</i> Supervise undergraduate final-year project	Sep. 2022 - Present
<b>Teaching assistant</b>   <i>Teaching assistant</i> (2023 - 2024) ELEC 421: advanced topic in image & signal processing (2020 - 2024) EECE 571E & ELEC 433 (Error Control Coding); (2022 - 2023) CPEN 491/492 (Capstone project) (2022 - 2023) ELEC 221 (Introduction to signal processing)	Sep. 2020 - Present

## SCHOLARSHIP

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UBC Graduate Support Initiative (GSI) award (CAD 7,000)  
UBC Transdisciplinary Collaborative PhD Pilot Fellowship (8 students across UBC) 2022-2023 (CAD 25,000)  
UBC International student award (CAD 3,000)  
UA NSERC Dean's research award, 2018 (CAD 1,000))  
UA Educational abroad individual award, 2018 (CAD 5,500)  
German Academic Exchange Service scholarship (DAAD) (4/144), 2018 (EUR 6,000)  
UA Faculty of Engineering academic excellence scholarship, 2016 - 2019 (CAD 8,000)  
UA International student scholarship, 2015 (CAD 8,000)