

# WENBO CHEN

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## EDUCATION

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**Georgia Institute of Technology** Aug. 2019 - May. 2024 (Expected)

- Ph.D. in Machine Learning, Minor in Operations Research, Advisor: [Prof. Pascal Van Hentenryck](#)
- Home School: The H. Milton Stewart School of Industrial and Systems Engineering (ISyE)
- Thesis Topic: End-to-End Learning and Optimization with Applications in Power Systems and Supply Chains

**Huazhong University of Science and Technology (HUST)** Sept. 2015 - June. 2019

- Bachelor of Engineering, Electrical Engineering
- Selected to the Outstanding Engineer Class (top 2%, on basis of outstanding academic performance)

## RESEARCH INTERESTS

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My research interest is in the intersection of **Machine Learning and Computational Optimization**. I design **reliable, efficient, and scalable decision-making** tools with the integration of Machine Learning (ML) and Mathematical Optimization for large-scale systems driven by the societal challenges in **power systems, supply chains and mobility**. The methodology can be categorized into the following two areas:

1. **Machine Learning for Real-Time Optimization:** Enable real-time decision making at scale by developing **optimization proxies** (i.e., computationally efficient ML surrogates) that approximate computationally expensive optimization models.
2. **Optimization for Reliable Machine Learning:** Enable reliable and robust ML models by developing scalable **differentiable optimization** layer to ensure models' outputs satisfy hard constraints, designing **formal verification** to prove models' exact robustness and developing **conformal prediction** to provide statistical guarantees on model performances.

## AWARDS AND HONORS

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- Anderson-Interface Fellowship for Excellence in Research, Georgia Tech, 2023  
Annual Distinction Recognizing Outstanding Contributions in Energy and Sustainable Systems
- Winner of Thesis Pitch Competition in ML and Manufacturing, IISE Annual Conference, 2023  
Title: Towards Real-time Risk Assessment in High-Renewable Power Systems
- 2023 Grid Science Winter School and Conference Travel Grant, Los Alamos National Lab, 2023
- Verification of Neural Networks Competition Outstanding Benchmark VNN-COMP, 2023
- Seth Bonder Fellowship, Georgia Tech, 2021, 2022, 2023
- School of Computer Science Chair's Fellowship, Georgia Tech, 2019
- Science and Technology Innovation Fellowship, HUST, 2018
- Outstanding Individual in University Students Innovation and Entrepreneurship Project, HUST, 2018

## PUBLICATIONS

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### Published Journal Papers

1. **Wenbo Chen**, Mathieu Tanneau, Pascal Van Hentenryck. “End-to-End Feasible Optimization Proxies for Large-Scale Economic Dispatch.” *IEEE Transactions on Power Systems (TPWRS)*, vol. 39, no. 2, pp. 4723-4734, March 2024, doi:10.1109/TPWRS.2023.3317352. [\[pdf\]](#)
2. Seonho Park, **Wenbo Chen**, Terrence W.K. Mak, Pascal Van Hentenryck. “Compact Optimization Learning for AC Optimal Power Flow.” *IEEE Transactions on Power Systems (TPWRS)*, vol. 39, no. 2, pp. 4350-4359, March 2024, doi: 10.1109/TPWRS.2023.3313438. [\[pdf\]](#)
3. Seonho Park, **Wenbo Chen**, Dahye Han, Mathieu Tanneau, Pascal Van Hentenryck. “Confidence-Aware Graph Neural Networks for Large-Scale Reliability Assessment Commitments in Power Systems.” *IEEE Transactions on Power Systems (TPWRS)*, vol. 39, no. 2, pp. 3839-3850, March 2024, doi: 10.1109/TPWRS.2023.3298735. [\[pdf\]](#)
4. **Wenbo Chen**, Seonho Park, Mathieu Tanneau, Pascal Van Hentenryck. “Learning Optimization Proxies for Large-Scale Security-Constrained Economic Dispatch.” *Electric Power Systems Research (EPSR)*, 2022. [\[pdf\]](#)
5. Enpeng Yuan, **Wenbo Chen**, Pascal Van Hentenryck. “Reinforcement Learning from Optimization Proxy for Ride-Hailing Vehicle Relocation.” *Journal of Artificial Intelligence Research (JAIR)*, Nov. 2022. [\[pdf\]](#)
6. **Wenbo Chen**, Anni Zhou, Pan Zhou, Liang Gao, Shouling Ji, and Dapeng Oliver Wu. “A Privacy-Preserving Online Learning Approach for Incentive-based Demand Response in Smart Grid.” *IEEE System Journal (IEEE SystJ)*, Dec. 2019. [\[pdf\]](#)
7. Pan Zhou, **Wenbo Chen**, Shouling Ji, Hao Jiang, Li Yu and Dapeng Oliver Wu. “Privacy-Preserving Online Task Allocation in Edge-Computing-Enabled Massive Crowdsensing.” *IEEE Internet of Things Journal (IEEE IoT-J)*, Oct. 2019. [\[pdf\]](#)
8. **Wenbo Chen**, Pan Zhou, Shaokang Dong, Shimin Gong, Menglan Hu, Kehao Wang, and Dapeng Oliver Wu. “Tree-based Contextual Learning for Online Job or Candidate Recommendation with Big Data Support in Professional Social Networks.” *IEEE ACCESS*, Nov. 2018. [\[pdf\]](#)

### Refereed Conference Papers

9. Haoran Sun, **Wenbo Chen**, Hui Li, Le Song. “Improving Learning to Branch via Reinforcement Learning.” *Learning Meets Combinatorial Optimization Workshop, 34rd Conference on Neural Information Processing Systems (NeurIPS)*, 2020. [\[pdf\]](#) [\[poster\]](#)

### Preprints

10. Ritesh Ojha\*, **Wenbo Chen**\*, Hanyu Zhang, Reem Khir, Alan Erera, Pascal Van Hentenryck. “Optimization-based Learning for Dynamic Load Planning in Trucking Service Networks.” *Transportation Science*, [Under review]. [\[pdf\]](#) \*co-first authors
11. Jiawei Lu, Tinghan Ye, **Wenbo Chen**, Pascal Van Hentenryck. “Boosting Column Generation with Graph Neural Networks for Joint Rider Trip Planning and Crew Shift Scheduling.” *Transportation Research: Part C*, [Under review]. [\[pdf\]](#)
12. Oliver Stover, Pranav Karve, Sankaran Mahadevan, **Wenbo Chen**, Haoruo Zhao, Mathieu Tanneau, Pascal Van Hentenryck. “Just-In-Time Learning for Operational Risk Assessment in Power Grids.” *IEEE Transactions on Power Systems (TPWRS)*, [Under review]. [\[pdf\]](#)

13. **Wenbo Chen**, Haoruo Zhao, Mathieu Tanneau, Pascal Van Hentenryck. “Compact Optimality Verification for Optimization Proxies.” *International Conference on Machine Learning (ICML)*, 2024. [Under review]
14. **Wenbo Chen**, Mathieu Tanneau, Pascal Van Hentenryck. “Real-Time Risk Analysis with Optimization Proxies.” *Electric Power Systems Research (EPSR)*, 2024. [Under revision][pdf]
15. **Wenbo Chen**, Reem Khir, Pascal Van Hentenryck. “Two-Stage Learning for the Flexible Job Shop Scheduling Problem.” *INFORMS Journal on Computing*, [To be submitted]. [pdf]

## PATENTS

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1. Mathieu Tanneau, Wenbo Chen, Minas Chatzos, Dahye Han, Hanyu Zhang, Haoruo Zhao “Risk-assessment Simulator for Power Systems”, Filed.
2. Pascal Van Hentenryck, Wenbo Chen, Mathieu Tanneau, “End-to-End Feasible Optimization Proxies for Large-Scale Economic Dispatch”, Filed.
3. Pascal Van Hentenryck, Wenbo Chen, Seonho Park, Terrence W.K. Mak, “Compact Optimization Learning for AC Optimal Power Flow”, Filed.
4. Pascal Van Hentenryck, Wenbo Chen, Seonho Park, Dahye Han, Mathieu Tanneau, “Confidence-Aware Graph Neural Networks for Large-Scale Reliability Assessment Commitments in Power Systems”, Filed.
5. Pascal Van Hentenryck, Wenbo Chen, Reem Khir, Alan Erera, Ritesh Ojha, “Optimization-based Learning for Dynamic Load Planning in Trucking Service Networks”, Filed.

## RESEARCH HIGHLIGHT

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### Learning Optimization Proxies for Large-Scale Energy Market Planning (**RAMC**)[1-4][12-14]

- Collaborated with **MISO**, the second largest electric system in the United States, and **RTE**, the largest electricity transmission grid operator in Europe.
- Proposed end-to-end, **self-supervised** ML surrogate for MISO economic dispatch on up to **30,000 buses system** with **feasibility guarantee**. It achieves **5 orders of magnitude faster** than **GUROBI** (the fastest commercial solver) with the optimality gap less than **0.5%**.
- Proposed confidence-aware graph neural network to accelerate solving **security-constrained unit commitment** on **RTE** system (a mixed-integer linear program with millions of decision variables and constraints). It generates feasible solutions with **0.77% optimality gap with 4 times speedup** than **GUROBI**.
- Proposed real-time risk assessment via optimization proxies. It accurately captures the system risks in high fidelity, **achieving 1,000 times speedup** than the optimization-based risk assessment.

### Optimization-based Learning for Dynamic Load Planning in Trucking Service Networks [10]

- Collaborated with a major parcel delivery company in the world.
- Proposed a symmetry-breaking Mixed-Integer Program formulation for dynamic load planning. The model generates **consistent** load plans and is solved to **1% optimality gap** on large industrial instances in 30 mins.
- Proposed the optimization proxies for dynamic load planning problems with efficient feasibility restoration.
- The proxies generate **feasible, consistent and near-optimal** solutions in seconds with **2 orders of magnitude faster** than **GUROBI** on large-scale industrial instances.

## INDUSTRY COLLABORATIONS

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### Keysight

Jan 2023 - Present

*Research Assistant for Industrial Collaborator*

Developing testing methodologies (including **explainability**, **verification**, and **uncertainty quantification**) for Keysight AI products e.g., error code correction transformer and cell measurement time series predictor.

### Kinaxis

Jan 2023 - Dec 2023

*Research Intern*

Developed learning-assisted optimization solver for **rapid response** in the large-scale supply chain planning.

### United Parcel Service (UPS)

Aug 2022 - Present

*Research Assistant for Industrial Collaborator*

Designed optimization proxies for dynamic load planning in the service network design.

### Midcontinent Independent System Operator (MISO)

Jan 2021 - May 2023

*Research Assistant for Industrial Collaborator*

Proposed learning optimization proxies for real-time risk assessment in real-world energy market clearing on large-scale energy system (MISO system)

### Ant Financial (subsidiary of Alibaba)

Jun 2020 - Aug 2020

*Research Intern*

Proposed a GCN-based variable selector for branch and bound framework to accelerate solving process of mixed integer programming solver.

## TEACHING

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- [HerWill Datathon 2022](#) (Mentor), HerWill, Spring 2022
- [Seth Bonder Summer Camp](#) (Lab Instructor), Georgia Tech, Summer 2021, 2022, 2023
- CS 7545 Machine Learning Theory (Course Materials Design & Office hours), Georgia Tech, Fall 2020
- CS 7632 Game AI (Grading & Office hours), Georgia Tech, Summer 2020

## INVITED PRESENTATIONS

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- Northeastern University, Shahin Shahrampour's Group, "Synergizing Machine Learning and Optimization: Scalable Real-Time Decision Making in Energy and Supply Chains", Nov 2023, Virtual
- INFORMS Annual Conference, "End-to-End Feasible Optimization Proxies for Large-Scale Economic Dispatch", October 2023, Phoenix, AZ
- NSF AI4OPF Annual Review, "End-to-End Learning and Optimization", Jun 2023, Atlanta, GA
- IISE Annual Conference, "Confidence-Aware Graph Neural Networks for Learning Reliability Assessment Commitments", May 2023, New Orleans, LA
- Google Research Operations Research, "Machine Learning for Discrete Optimization and Applications in Power Systems and Supply Chains", May 2023, Virtual

- INFORMS Annual Conference, “Learning Optimization Proxies for Large-Scale Security-Constrained Economic Dispatch”, October 2022, Indianapolis, IN
- ISyE Student Seminar, “Learning Optimization Proxies for Large-Scale Security-Constrained Economic Dispatch”, April 2022, Georgia Tech

## **SERVICE**

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- Journal Reviewer: INFORMS Journal on Computing, IEEE Transactions on Power Systems, IEEE Transactions on Sustainable Energy, Electric Power Systems Research
- Conference Reviewer: PSCC 2022 2024, ICML 2023, NeurIPS 2023, AAMAS 2022
- Public and Community Service: Mentor for HerWill Datathon 2022, Lab instructor for Seth Bonder Camp