WENJIE XU

https://jackiexuw.github.io/
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RESEARCH INTERESTS

My current research interests are twofold.

- ***Data-driven Optimization*** Optimization theory and algorithms for the problems that involve elements that are extremely expensive to model from first principle, but rather can be learned with data (e.g., Bayesian optimization, derivative-free optimization, grey-box optimization, etc.).
- ***Applications to Energy Management*** Developing data-driven models and algorithms, to improve the energy efficiency of critical built environment and appliances (e.g., heavy-duty truck, residential building and vapor compression system, etc.).

EDUCATION

École polytechnique fédérale de Lausanne (EPFL), Lausanne
Ph.D. candidate, Electrical Engineering *February 2021 - March 2025 (Anticipated)*
Advised by Prof. **Colin Jones** and co-advised by Dr. **Bratislav Svetozarevic**

The Chinese University of Hong Kong, Hong Kong
MPhil, Information Engineering *August 2018 - July 2020*
Advised by Prof. **Minghua Chen**
Thesis: Ride the Tide of Traffic Conditions: Opportunistic Driving Improves Energy Efficiency of Timely Truck Transportation

Tsinghua University, Beijing
B.E., Electronic Engineering *August 2014 - July 2018*
B.S., Mathematics *September 2015 - July 2018*

WORK EXPERIENCE

Advanced Institute of Information Technology, Peking University, Hangzhou
Algorithm Engineer Intern *November, 2020-January, 2021*

Kolmostar Inc., Beijing
Algorithm Engineer Intern *October, 2017-July, 2018*

The Chinese University of Hong Kong, Hong Kong
Research Assistant *June, 2017-August, 2017*

SELECTED AWARDS

- ASME Energy Systems Technical Committee Best Paper Award at ACC, 2022
- SIGMOBILE student travel grant for ACM BuildSys 2019
- 1st Prize for the National Undergraduate Physics Olympiad, 2015
- Academic excellence award, yearly 2014-2018, Tsinghua University

PUBLICATIONS

* indicates equal contribution.

Conference Papers

1. **Wenjie Xu**, Yuning Jiang, Bratislav Svetozarevic, and Colin N Jones. Primal-dual contextual Bayesian optimization for control system online optimization with time-average constraints. In *the 62nd IEEE Conference on Decision and Control*, **CDC** 2023 [PDF]

2. **Wenjie Xu**, Yuning Jiang, Bratislav Svetozarevic, and Colin N Jones. Constrained efficient global optimization of expensive black-box functions. In *the Fortieth International Conference on Machine Learning*, **ICML** 2023 [arXiv]

3. **Wenjie Xu**, Yuning Jiang, Bratislav Svetozarevic, Philipp Heer, and Colin N Jones. CONFIG: Constrained efficient global optimization for closed-loop control system optimization with unmodeled constraints. In *IFAC World Congress*, 2023 [arXiv]

4. **Wenjie Xu**, Colin N Jones, Bratislav Svetozarevic, Christopher R Laughman, and Ankush Chakrabarty. VABO: Violation-Aware Bayesian Optimization for closed-loop control performance optimization with unmodeled constraints. In *IEEE American Control Conference (ACC)*, **ACC** 2022 ASME ESTC Best Paper Award [PDF]

5. Runzhi Zhou, Qingyu Liu, **Wenjie Xu**, Minghua Chen, and Haibo Zeng. Minimizing emission for timely truck transportation with adaptive fuel injection. *The 7th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation*, **BuildSys** 2020 [PDF]

6. Yaowei Long*, Zidong Wu*, Hongyi Liu*, Titing Cui, **Wenjie Xu**, and Minghua Chen. Demo abstract: Online path and speed planning platform for energy-efficient timely truck transportation. *The 6th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation*, **BuildSys** 2019 (Demo paper) [PDF]

7. **Wenjie Xu**, Qingyu Liu, Minghua Chen, and Haibo Zeng. Ride the tide of traffic conditions: Opportunistic driving improves energy efficiency of long-haul timely truck transportation. *The 6th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation*, **BuildSys** 2019 [PDF]

8. **Wenjie Xu**, Qingyu Liu, Minghua Chen, and Haibo Zeng. Opportunistic driving: a critical design space for reducing fuelconsumption of timely long-haul truck transportation. *Tenth ACM International Conference on Future Energy Systems*, **e-Energy** 2019 (poster paper) [PDF]

9. Qiulin Lin, **Wenjie Xu**, Minghua Chen, and Xiaojun Lin. A probabilistic approach for demand-aware ride-sharing optimization. *International Symposium on Mobile Ad Hoc Networking and Computing*, **MobiHoc** 2019 [PDF][Technical Report]

10. **Wenjie Xu**, Deliang Chang, and Xing Li. On the classification and false alarm of invalid prefixes in RPKI based BGP route origin validation. *IFIP/IEEE International Symposium on Integrated Network Management*, **IM** 2019 (short paper) [PDF]

Journal Articles

1. **Wenjie Xu**, Bratislav Svetozarevic, Loris Di Natale, Philipp Heer, and Colin N Jones. Data-driven adaptive building thermal controller tuning with constraints: A primal-dual contextual Bayesian optimization approach. *Applied Energy*, **APEN, under review** [arXiv]

2. **Wenjie Xu**, Colin N Jones, Bratislav Svetozarevic, Christopher R Laughman, and Ankush Chakrabarty. Violation-aware contextual Bayesian optimization for controller performance optimization with unmodeled constraints. *Journal of Process Control*, **JPC, under review** [arXiv]

3. **Wenjie Xu**, Yuning Jiang, Emilio T Maddalena, and Colin N Jones. Lower bounds on the worst-case complexity of efficient global optimization. *Journal of Optimization Theory and Applications*, **JOTA, under review** [arXiv]

4. **Wenjie Xu**, Qingyu Liu, Minghua Chen, and Haibo Zeng. Ride the tide of traffic conditions: Opportunistic driving improves energy efficiency of long-haul timely truck transportation. *IEEE Transactions on Intelligent Transportation Systems*, **T-ITS, accepted**, 2023 [PDF]

5. **Wenjie Xu***, Titing Cui*, and Minghua Chen. Optimizing two-truck platooning with deadlines. *IEEE Transactions on Intelligent Transportation Systems*, **T-ITS, accepted**, 2022 [PDF]

6. Xiuqiong Chen, Yangtianze Tao, **Wenjie Xu**, and Stephen S.-T. Yau. Recurrent neural networks are universal approximators with stochastic inputs. *IEEE Transactions on Neural Networks and Learning Systems*, **T-NNLS, accepted**, 2022 [PDF]

Preprints

1. **Wenjie Xu**, Yuning Jiang, Bratislav Svetozarevic, and Colin N. Jones. Multi-agent Bayesian optimization with coupled black-box and affine constraints. [arXiv]

2. **Wenjie Xu**, Yuning Jiang, Bratislav Svetozarevic, and Colin N Jones. Bayesian optimization of expensive nested grey-box functions. [arXiv]

SERVICES

- **Journal Reviewer**:
  - IEEE Transactions on Automatic Control
  - IEEE Transactions on Neural Networks and Learning Systems
  - Optimal Control Applications and Methods
  - ACM Digital Threats: Research and Practice
- **Conference Reviewer**:
  - IEEE Conference on Decision and Control (2022, 2023)
  - American Control Conference (2022)

TALKS

1. **CONFIG: CONstrained efFIcient Global Optimization of Expensive Black-Box Functions**
   - IFAC World Congress — Jul., 2023
   - MEchanics GAthering-MEGA-Seminar, EPFL — Mar., 2023
   - PhD Seminar, Swiss Federal Laboratories for Materials Science and Technology — Feb., 2023
   - Annual Meeting, Chinese Association of Science & Technology in Switzerland — Dec., 2022
   - Design and Analysis of Networked, Computing, and Energy (DANCE) Systems Lab, City University of Hong Kong — Dec., 2022
2. **Ride the Tide of Traffic Conditions: Opportunistic Driving Improves Energy Efficiency of Timely Truck Transportation**
   - BuildSys 2019, oral presentation — Nov., 2019
   - Laboratory of Automatic Control, EPFL, virtual — Aug., 2020

SELECTED PROJECTS

Bayesian optimization for automatic controller tuning in energy systems
Joint work with ***Yuning Jiang*** *and* ***Colin Jones*** *from EPFL,* ***Bratislav Svetozarevic*** *from Empa*
In this project, we develop theory, algorithm and software of Bayesian optimization (a.k.a., efficient global optimization) method to automatically tune the performance of parameterized controller to improve the energy efficiency and the sustainability of critical built environments/appliances. Compared to the state-of-the-art methods, we have been developing methods that simultaneously optimize the objective and manage the constraint violation well. The applications on real-world energy system (e.g., building system) have demonstrated promising results. We also extend the generic black-box Bayesian optimization to the more general grey-box setting and the distributed multi-agent setting.

Energy-efficient operation of timely truck transportation
Joint work with ***Minghua Chen*** *from CityU of Hong Kong,* ***Qingyu Liu*** *and* ***Haibo Zeng*** *from Virginia Tech, and* ***Titing Cui*** *from University of Pittsburgh*
This project aims to develop models and algorithms to tackle the problem of path planning, speed planning, opportunistic driving planning and platooning planning for energy efficient long-haul truck operation with deadline constraints. *Opportunistic driving* is a new design space we introduced. The idea is letting trucks strategically rest at the rest areas to wait for favorable traffic condition to traverse. Furthermore, we developed novel phase-based optimization method to optimize opportunistic driving under dynamic traffic condition. We are also investigating game theoretical analysis when multiple trucks simultaneously do opportunistic driving. We have also developed advanced algorithms to do two truck platooning optimization.

STUDENTS (CO-)MENTORED

Vincent Juillard (Fall, 2023), master student at EPFL
Jiarui Yu (Spring, Summer, and Fall, 2023), master student at EPFL
Pennacino Victor Ying-Chi (Spring, 2023), master student at EPFL
Yuehang Sun (Spring, 2023), master student at EPFL → BYD Shanghai
Tirui Cao (Summer, 2019), bachelor student at Tsinghua University → PhD student at Tsinghua University
Dafei Qin (Summer, 2019), bachelor student at Tsinghua University → PhD student at the University of Hong Kong
Yaowei Long (Summer, 2019), bachelor student at Tsinghua University → PhD student at the University of Michigan

TEACHING EXPERIENCE

Teaching assistant, **EPFL ME-321: Control Systems + TP** (Fall 2023)
Teaching assistant, **EPFL MICRO-453: Robotics Practicals** (Spring 2023)
Teaching assistant, **EPFL ME-390: Foundations of Artificial Intelligence** (Fall 2022)
Teaching assistant, **EPFL ME-425: Model Predictive Control** (Fall 2023, Fall 2022, Fall 2021)
Teaching assistant, **EPFL MGT-483: Optimal Decision Making** (Spring 2022)
Teaching assistant, **CUHK CSCI2100: Data Structure** (Spring 2020)
Teaching assistant, **CUHK IERG3080: Information and Software Engineering** (Fall 2019)
Teaching assistant, **CUHK ENGG2470A: Introduction to Probability and Statistics** (Spring 2019)
Teaching assistant, **CUHK IERG 4300: Web-scale Information Analytics** (Fall 2018)

SKILLS

Language: English, Chinese (native)
Programming language: python, C++
Tools: LaTeX