Jiguang Wang

University of Hong Kong, Hong Kong, China | +86 15935325890, +052 69986335| wangjg2020@163.com

EDUCATION

University of Hong Kong, Department of Civil Engineering   Ph.D. Transportation Engineering, 2023-Present   HongKong, China
Supervisor: Dr. Jintao Ke, **University of Hong Kong**

Tsinghua University, Tsinghua Berkeley Shenzhen Institute   M.S. Management Science and Engineering, 2023   Shenzhen, China
Supervisor: Prof. Wai Kin (Victor) Chan, Tsinghua University
Honors/Awards:

The **Second-class Scholarship** of Tsinghua University; The **First-class Scholarship** for Academic Research of Shenzhen International Graduate School; **National Second Prize** of Huawei Cup Mathematical Modeling Contest for Graduate Students; **Second prize** in Shanghai College Student Transportation Innovation Competition

Shanghai Maritime University, School of Logistics Engineering   B.S. logistics engineering, 2020   Shanghai, China
Honors/Awards:

National Encouragement Scholarship (twice); Huawei Scholarship; School Outstanding Student; **First Prize** of National College Business Elite Logistics Practice Competition (national top 10); **Second Prize** in American Mathematical Contest in Modeling; **First Prize** of Shanghai Division of Contemporary Undergraduate Mathematical Contest in Modeling; **First prize** in Shanghai College Entrepreneurial Decision Simulation Competition

Research Interests:
Data-driven optimization, Operations research, Urban mobility, Integer programming

PUBLICATIONS

- **Jiguang Wang,** Yilun Zhang, Xinjie Xing, et al. (2022). A Data-Driven System for Cooperative-Bus Route Planning Based on Generative Adversarial Network and Metric Learning. **Annals of Operations Research. (IF 4.820)**
- Ke Zhang, Meng Li, **Jiguang Wang**, et al. (2023). A Two-stage Learning-based Method for Large-scale On-demand Pickup and Delivery Services with Late Penalties. **Transportation Research Part C. (IF 9.022)**
- Caiyue Zhao, **Jiguang Wang**, Simei Mao, et al. (2023). Reinforcement learning optimization for a compact optical neural network composed of nanostructured 2×2 Optical Processors. **IEEE Photonics Journal (IF 2.25)**
- Ting Zhang, Xinglu Liu, **Jiguang Wang**, et al. (2023,). Improve Data Mining Performance by Noise Redistribution: A Mixed Integer Programming Formulation. In 2023 IEEE International Conference on Smart Internet of Things (SmartIoT) (pp. 190-195). IEEE.
- **Jiguang Wang**, Yi Zhang, Xinglu Liu, et al. (2021). A Reinforcement Learning Approach for Optimization of E-bus Off-normal Schedule with Time Windows.2021 IEEE International Conference on Industrial Engineering and Engineering Management (**IEEM 2021**) (EI) (oral presentation)
- Yi Zhang, **Jiguang Wang**, Xinglu Liu, et al. (2021). A Heuristic Algorithm for Time-dependent Bus Scheduling Problem. 2021 IEEE International Conference on Industrial Engineering and Engineering Management (**IEEM 2021**) (EI)
- Ting Zhang, Xinglu Liu, **Jiguang Wang**, et al. (2022). A New Optimization Model MVD designed for Data Perturbation. 2022 the 7th International Conference on Big Data Analytics (**ICBDA 2022**) (Best paper award) (EI)
- Xinglu Liu, Kefan Lai, …, **Jiguang Wang**, et al. (2023). 数学建模与数学规划:方法、案例及编程实战 Python+COPT+Gurobi 实现.电子工业出版社,待出版
- **Jiguang Wang**, Zhide Li, Victor Chan, et al. (2021). Shared bus line-pasting scheduling method based on reinforcement learning. [P] Chinese patent. CN113673836A,2021-11-19, authorized.
- **Jiguang Wang**, Zhide Li, Xinglu Liu, et al. (2022). Route planning method for the cooperative bus. [P] Chinese patent. CN114518763A,2022-05-20, authorized.

TRANSPORTATION RESEARCH EXPERIENCE

A Two-stage learning-based method for large-scale on-demand pickup and delivery services   Mar.2022 – Mar.2023

- Design a **two-stage learning-based framework** for efficiently solving the PDPTW problem, enabling rapid resolution of large-scale problems within **seconds**
- In the **clustering stage**, a graph convolutional neural network with an embedded **attention** mechanism is employed to capture and learn **the path structures** between customer locations and their respective vehicles in the optimal solution. In the second routing stage, a pre-trained **encoder-decoder deep reinforcement learning model** is used to generate the paths for each vehicle
- The learning-based approach proposed in this study significantly improved efficiency and solution quality over OR-tools and ALNS, achieving approximately **31%** enhancement in solving large-scale problems with **500 demand points**

Route planning of new urban shuttle buses based on GAN and metric learning   Jun. 2021 – Jan. 2023

- Devised a novel shuttle bus scheme in collaboration with ordinary buses to bridge the gap between capacity and demand
- Utilized **Metric learning** to segment different traffic scenarios and employed a generative adversarial network (GAN) to predict demand. Numerical studies demonstrated our approach outperformed the benchmark by an **impressive 14%**

- Developed a mixed-integer nonlinear programming model to maximize customer satisfaction, which was further **linearized by a custom reformulation model**, resulting in a **100 times increase** in solution speed during numerical experiments
- Adopted the **Column generation-based ALNS** algorithm to tackle large-scale problems, achieving a **less than 1% gap** between the obtained results and the optimal solution

Pattern recognition of large-scale urban traffic flow, *Service lab of HUAWEI 2012 Lab, Algorithm intern*   Jun. 2021 – Sep. 2021
- Developed a **bi-level machine learning framework** to accurately identify traffic flow patterns
- Introduced a lower-level **unsupervised learning model** based on metric learning to effectively segment traffic scenarios. This model facilitated the provision of more targeted training samples to the upper traffic flow pattern recognition model, which utilized deep learning techniques
- Incorporated **unsupervised clustering results and supervised learning** random forest importance indexes to iteratively update weights in the clustering objective function. Numerical studies demonstrated that our approach outperformed the benchmark by an impressive **10%**

Urban E-buses scheduling optimization based on reinforcement learning   Jan.2021 – Jun. 2021
- Implemented a revenue maximization strategy for E-bus operations, while accounting for constraints on departure frequency and return
- Employed **multi-agent Q-learning reinforcement learning** to optimize the system's performance. Developed an environment based on real data, utilizing weekday and holiday passenger flow distribution. Predicted passenger flow using logistic regression and employed K-means for pattern extraction
- For large-scale problems, employed **a greedy algorithm** to obtain an initial solution, subsequently enhanced through a **neighborhood search method** resulting in a notable **10%** increase in expected income

The locating and sizing of electric vehicle charging stations   Apr.2021 – Jun. 2021
- Segmented the charging demand based on region and type, while considering **customers' sensitivity** to charging costs. Applied a **clustering algorithm** to classify alternative charging stations
- Developed **a mixed-integer stochastic programming model** to minimize costs and maximize benefits. Utilized the **sample means approximation (SAA)** algorithm to transform the model into a deterministic optimization problem, which was efficiently solved using Gurobi

Flight crew scheduling optimization and branch-cut algorithm, *Huawei Cup Mathematical Modeling Contest*   Oct.2021 – Nov. 2021
- Introduced **a compact crew scheduling optimization model** to efficiently maximize flight crew match rates and minimize costs, while considering duty, task loop, and crew task continuity constraints
- Designed a **branch-and-cut algorithm** based on variable neighborhood search to accommodate the constraints and reduce the model size. Incorporated customized linearization, symmetry elimination, and effective inequality techniques based on **LazyCut** to further enhance the optimization process

Joint scheduling and charging of port IGV based on reinforcement learning and genetic algorithm   Jan.2020 – Jun. 2021
- Developed a simulation-based optimization method to **jointly optimize the charging strategy and route planning** for port Intelligent Guided Vehicles (IGVs)
- Implemented an improved **genetic algorithm** to solve the optimal charging strategy for IGVs, with considerations such as electricity upper limits and overall port efficiency. Utilized an unsupervised learning method to analyze loading and unloading tasks, followed by the application of a reinforcement learning algorithm to determine optimal task selection and route planning for IGVs under various conditions. Through rigorous numerical verification and simulation, demonstrated a remarkable **30%** improvement in the overall efficiency of the port

OTHER RESEARCH EXPERIENCE

- Utilize a combination of machine learning and operations research techniques to develop a comprehensive **quantitative stock selection strategy**. Devise **customized features** to train the Xgboost model for accurate stock yield predictions. Additionally, design risk indicators and formulate a **robust optimization model** utilizing Gurobi to maximize returns even in worst-case scenarios
- Developed an **end-to-end optimal** design approach for discrete optical devices by leveraging **Deep Q-Network** to predict optimal designs with enhanced generalization, robustness, and operability. Employed **Variational Auto Encoder (VAE)** to reduce the dimensionality of device structures in reinforcement learning. Additionally, proposed a high-efficiency matrix multiplication method to accelerate optimization, resulting in a remarkable **91%** improvement in classification accuracy

SKILLS AND OTHERS

*Programming language: **Python, Gurobi,** Matlab, SPSS, Area, Office Origin, Latex, etc*
Certificate: Senior Warehouse Manager professional certificate, Assistant Logistics Service professional certificate
Others:
- The core member of WeChat public account "**OlittleR**" (运小筹), which has more than **24K fans** in the operations field, and the total pageviews of my works "deep Q network", "Dijkstra algorithm" and "traffic feature engineering" and so on is more than 10K
- Volunteers in **Hong Kong Society for Transportation Studies (HKSTS2023)**, Hongkong, China, 2023
- Volunteers in **the 9th International Symposium on Transport Network Resilience (INSTR2023)**, Hongkong, China, 2023
- Volunteers in **Informs Conference on Service Science (ICSS2022)**, Shenzhen, China, 2022
- Volunteers in **Intelligent Transportation Summit Forum**, Qianhai Institute of Intelligent Transportation, University of Hong Kong, 2023