

# Ruoyun Ma

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## EDUCATION

**Tsinghua University, Beijing, China** 08/2015 - 07/2019 (Expected)

- B.S. in Environmental Engineering, School of Environment. GPA: 3.70/4.0 (Overall)
- Core Courses (A+/A: 95-100; A-: 90-94)  
**Mathematics:** Calculus 1 (A+), Calculus 2 (A), Linear Algebra (A), Probability and Statistics (A)  
**Major:** Solid Waste Treatment and Disposal Engineering (A), Air Pollution Control Engineering (A-), Environmental Planning (A-), Inorganic and Analytical Chemistry (A-), Organic Chemistry (A-), Physical Chemistry (A-)  
**Current:** Traffic Engineering, Data Structure and Algorithms, Operation Research

**Tsinghua University, Beijing, China** 09/2016 - 07/2019 (Expected)

- B.S. in Economics, School of Economics and Management. GPA: 3.59

**University of Michigan, Ann Arbor, MI, USA** 07/2018 - 08/2018

- Visiting Research Student, Lab for Innovative Mobility System, Department of Civil and Environmental Engineering
- Research Topic: Ride-sourcing electric vehicle behavior modeling; Charging infrastructure optimization.

## PUBLICATION, CONFERENCE & PATENT

- **Ruoyun Ma**, Xiaoyi He, Ye Wu\*. Using an iterative Markov Chain process to develop driving cycles based on large-scale GPS data: a case study in Beijing. Poster presented at: 22<sup>nd</sup> International Transport and Air Pollution Conference, 2017 Nov 15-16, Zurich, Switzerland. [\[Poster\]](#)
- **Ruoyun Ma**, Xiaoyi He, Shaojun Zhang, Ye Wu\*, Wei Shen, Weijian Han. Variations of vehicle energy consumption informed by real-world GPS trajectory data and driving cycle. Submitted to Journal of Cleaner Production. [\[PDF\]](#)
- **Ruoyun Ma**, Pei Zhao, Xiaoyi He, Ye Wu, Zhi Kou, Weixiao Huang. A software platform for electric vehicle charging pile allocation optimization based on high-resolution charging demand analysis. China, Computer Software Copyright Registration. Application submitted.
- Pei Zhao, **Ruoyun Ma**, Xiaoyi He, Ye Wu. An optimization method of electric vehicle charging pile allocation based on high-resolution charging demand analysis. China, Patent for Invention. Application submitted.

## RESEARCH EXPERIENCES

**Tsinghua University, Beijing, China**

Principal Researcher; Advisor: [Prof. Ye Wu](#) (Vice Chair of School of Environment)

**The Development of Urban Driving Cycles for Private Cars Based on Markov Chain Process** 11/2016 - 05/2017

- Preprocessed second-by-second GPS data of 459 private passenger cars in Beijing by MATLAB, including data filtration, profile segmentation and key parameter calculation.
- Classified data into different driving states by K-means clustering; Applied Markov Chain approach to generate driving cycles with similar properties as real-world driving based on over 13 million speed-time segments; And selected candidate cycles to minimize relative errors.
- Matched trajectory records with Beijing urban road network by ArcGIS; Labeled segments temporally as off-peak hours or peak hours; And developed sub-cycles of different road types and travel time to differentiate driving patterns.
- Proposed for the first time an application of massive real-world data to develop driving cycles under fine-scale traffic situations, as well as an improved basis for emission estimation and fuel consumption simulation; Presented as 1<sup>st</sup> author at poster session of 22<sup>nd</sup> International Transport and Air Pollution Conference (TAP 2017).

**The Application of Driving Cycles on Vehicle Energy Consumption Evaluation** 03/2018 - 09/2018

- Analyzed comprehensive traffic characteristics further from the data covering 17,000 sampling days above, including velocity, acceleration, driving modes and their internal relations; Compared driving patterns of the derived cycles with standard driving cycles.
- Adopted the operating binning method to simulate vehicle energy consumption under the given driving cycle; Conducted pair analysis for various driving situations, reference criteria and load condition.
- Read copious literature for extensive discussion of simulation results; Summarized the pros and cons of different methods for driving cycle development; And completed the paper writing.
- Distinguished 15.0% and 24.3% higher fuel consumption under Beijing real-world off-peak cycle than NEDC-simulated, which enlarge to 26.2% and 36.4% compared with vehicle type approval. Emphasized the significance of

employing local real-world driving cycle, addressing traffic congestion and constricting related regulations; Submitted the paper to Journal of Cleaner Production as the 1<sup>st</sup> author.

### **Optimizing the Allocation of Urban Electric Vehicle Charging Piles**

11/2017 - 08/2017

- Extracted potential charging events from GPS trajectory records of 340 private electric vehicles over 750 months in total by MATLAB. Associated geographic POI data to the 1km × 1km city grid map. And distinguished surface features by ArcGIS.
- Analyzed charging demand by kernel density estimation, depicting the relationship among parking time, regional types, and charging duration. Simulated charging events of city grids according to population density and fitted demand function.
- Developed a heuristic to optimize charging pile allocation in city grids, maximizing the utilization ratio of charging piles as well as the convenience for drivers, subject to the constraints of given amount of charging piles and specified hypothetical scenarios of electric vehicle penetration.
- Provided a new perspective for private vehicles charging infrastructure optimization, based on high-resolution demand analysis. Cooperatively developed a visualized case website for Shanghai [[Chinese Version](#)]. Applying for patent of invention and software registration in China. Paper in preparation.

University of Michigan, Ann Arbor, MI, USA

07/2018 - Present

Principal Researcher, Advisor: [Prof. Yafeng Yin](#) (Transportation Research Part C, Editor in Chief)

### **Developing an Agent-based Model of Ride-sourcing Electric Vehicles for Charging Station Optimization**

- Developed a data-driven simulation model to mimic spatial and temporal travel behaviors of ride-sourcing electric vehicles (RSEVs). Adopted AnyLogic, an agent-based simulation software, to build framework and implement a set of behavior rules on taking orders and charging.
- Processed over 32 million ride-sourcing conventional vehicles trajectory records from DiDi by MATLAB, including data cleaning, coordinate correction and pattern analysis. Applied these data to the model. And calculated objective variables, total missed trips and utilization ratio of charging stations.
- Conducted sensitivity analysis to distinguish prominent parameters of the system. Developing heuristics based on metamodel approach to optimize charging station deployment plan.
- Constructed an agent-based model for RSEV driving behavior from a microcosmic perspective. Visualized the model on regional map and the variation of objectives simultaneously.

### **AWARDS & HONOR**

- Member of the 11th THU Spark Program (Selected students with talent/potential in scientific research, Top 1% university-wide) 12/2017
- Tsinghua-Suzhou Industrial Park Scholarship (Top 5%) 10/2016
- Tsinghua-Evergrande Scholarship (Top 5%) 10/2017
- Tsinghua-Veolia Scholarship (Top 5%) 10/2018
- Innovation Award of 13<sup>th</sup> National Environmental-friendly Science & Technology Competition (Top 5%) 09/2018
- Third Prize of 36<sup>th</sup> Tsinghua University Challenge Cup Science and Technology Competition (Top 15%) 05/2018
- Award for Comprehensive Excellence; Award for Excellence in Academic Performances; Award for Excellence in Scientific and Technology Innovations; Award for Excellence in Social Work, THU. 2016; 2017; 2018

### **LEADERSHIP & ACTIVITIES**

Student Union, School of Environment, THU | **Vice Chair**

09/2016 - 06/2017

- Developed ground-breaking cooperative relationship between student union and several successful enterprises (e.g., [Want Want Corp](#)), and obtained massive sponsorship for student activities (over ¥ 30,000).
- Creatively planned and organized a series of lectures on student career development, and invited alumni to share their personal experiences and the market insight, which were well received by participants.

### **TECHNICAL SKILLS**

Proficient in **literature research**, **general programming** and **data processing**

#### **Computer Skills**

- Proficient: C/C++, MATLAB, ArcGIS, AnyLogic, SPSS, Microsoft Office
- Familiar: AutoCAD, LaTeX, Python, Java

### **STANDARD TEST SCORES**

<b>TOEFL</b>	106	Reading 29, Listening 28, Speaking 22 (Best 23), Writing 27
<b>GRE</b>	325 + 4.0	Verbal 155, Quantitative 170, Analytical Writing 4.0