Yiyang Wang

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EDUCATION

University of Michigan, Ann Arbor — Ann Arbor, MI
Ph.D. in **Civil Engineering** (GPA: 3.96/4.00) — Dec 2022
w/ specialization in *Next Generation Transportation Systems*
M.S. in **Electrical Engineering and Computer Science** (GPA: 3.81/4.00) — Apr 2018
w/ specialization in *Signal & Image Processing and Machine Learning*

Jilin University — Changchun, China
B.Eng. in **Communications Engineering** (GPA:90.32/100, Rank: Top 1/91) — June 2016
w/ *National Scholarship Award*

SKILLS

- **Core Expertise:** Deep Learning, Reinforcement Learning, Causal Discovery/Inference, Time Series & Anomaly Detection, Combinatorial Optimization, Graph Algorithms
- **Programming Languages:** Python (Proficient), MATLAB (Proficient), SQL, R, C/C++
- **Packages & Tools:** PyTorch, Gurobi, NumPy, Pandas, Scikit-learn, GCP, TensorFlow, Git, Bash, Docker
- **Research Interests:** Machine Learning, NLP, Anomaly Detection, Multi-Armed Bandits, Combinatorial Optimization

PROFESSIONAL EXPERIENCE

Intel Corporation | Technology Development — Hillsboro, OR
Machine Learning Engineer — Jan 2023 - Present

- Adopted machine learning algorithms in **Python** to reduce the variation of device performance
- Conducted data analysis and casual discovery given limited and noisy inline measurement

SiriusXM & Pandora | Science Pandora Department — Oakland, CA
Science Intern - Recommendation, Search, & Voice — May 2022 - Aug 2022

- Built a **Siamese neural network with attention fusion** (PyTorch) for **semantic retrieval** of music on **GCP**; improved **recall by 22%** vs. production baseline and increased robustness to paraphrased/natural language queries.
- **Advanced NLP/retrieval:** engineered contrastive objectives (triplet/in-batch negatives) and indexed vectors with ANN for low-latency search at catalog scale.
- Built **PySpark** pipelines for data acquisition and query understanding (entity normalization, synonyms, spelling variants); developed offline evaluation harnesses (recall@K) with **Gensim** and **NLTK**.

Univ. of Michigan | Next Generation Mobility Systems Lab — Ann Arbor, MI
Research Associate — Sep 2018 - Dec 2018

- Designed an anomaly detection approach with time series trajectory data by combining **convolutional neural network (CNN)** and **Kalman filter** with χ^2-detector in **Python (PyTorch) & MATLAB** with F1 score **97.8**%
- Pre-processed the large-scale (more than 1GB) raw dataset (Safety Pilot Dataset) for training and testing using **SQL** to filter specific vehicle trajectories
- **Sensor fusion** with CNN to further improve detection performance (**14%** above benchmark) on time series dataset

Ford Motor Company | Research and Advanced Engineering (R&A) — Dearborn, MI
Product Development Intern — May 2018 - Jul 2018

- Forecasted the travel demand in 5 and 10 years of Ann Arbor city using a **four-step travel demand model**
- Used **logistic regression** for travel mode choice prediction, and **gravity model** for trip distribution prediction
- Predicted and visualized the traffic congestion level on each road in Ann Arbor city with **SUMO**, specified the roads need expansion

China Unicom | Network Management Center — Jinan, China
Network Telecommunications Engineer Intern — Jul 2015 - Sep 2015

- Enabled rapid and dynamic IP assignment to all China Unicom internet customers in Jinan city, by pre-allocating IP address resources in the IP address resources management system
- Tested the packet loss rate with **secureCRT** and fixed the line failures

RESEARCH EXPERIENCE

Dynamic Security Resource Allocation in Connected and Automated Vehicles
Python — Aug 2022 - Present

- Formulated a partially observable Markov Decision Process (POMDP) to prescribe an optimal policy for dynamical security resource allocation during the trip, which ensures the security and energy efficiency of CAVs
- Solved the POMDP model using **point based value iteration (PBVI)** algorithm in **Python**

Demand Forecasting and Vehicle Route Planning Algorithm in Benton Harbor
Python (Gurobi), MATLAB Jan 2021 - Jan 2022

- Forecasted travel demand and designed new transit routes in Benton Harbor to improve mobility for local residents, which increased the annual ridership up to **78%**
- Trained **radial basis function (RBF) network for regression**, with socioeconomic data, for travel demand forecasting by **MATLAB** with high accuracy (**RMSE 4.93**)
- Proposed and solved a demand-responsive optimization model in **Python & Gurobi** on large-scale datasets (preprocessed by **SQL**), which provided the optimal new bus routes
- Devised a graph aggregation-disaggregation algorithm (**Python** & **Gurobi**) which dynamically clustered the large-scale network to **reduce computation time**, and efficiently recovered from the aggregated solution (w/ convergence guaranteed)

Deep Reinforcement Learning-Bayesian Framework for Anomaly Detection
Python (PyTorch) July 2020 - Dec 2020

- Developed a POMDP model, which was solved by a novel and effective deep reinforcement learning algorithm (**A3C**), to online update CNN detecting anomalies in vehicle sensor data
- Outperformed state-of-the-art benchmarks (**12%** above CNN, **18%** above RNN) on large-scale dataset (Safety Pilot Dataset)

Adversarial Online Learning with Variable Plays in Sequential Game for Vehicle Cybersecurity
Python Sep 2019 - Oct 2020

- Devised a fast (no-regret) algorithm for the **adversarial multi-armed bandit with variable plays (MAB-VP)** problem to predict adversarial behaviours and tested on real dataset (Car-Hacking Dataset)
- Showed two directions on improving the cybersecurity from a game-theoretical perspective (**two-player sequential constant-sum games**): increase threat-monitoring resources, and/or increase reliability of the system

Anomaly Detection in Connected & Automated Vehicle Sensors
Python, MATLAB Jan 2019-Dec 2019

- Proposed an anomaly detection method for time series trajectory data by combining **Kalman filter** with unsupervised learning **One Class Support Vector Machine (OCSVM)** models, achieved AUC score **0.98/1.00** (**23%** above χ^2-detector benchmark)
- Conducted stability analysis of the platoon dynamics under cybersecurity uncertainties
- Derived an **augmented-state formulation** to further boost detection performance (up to **27%**) under **stochastic time delay**

TEACHING EXPERIENCE

CEE 373: Statistical Methods for Data Analysis and Uncertainty Modeling, Univ. of Michigan
Graduate Student Instructor Sep 2020 - Dec 2020
Sep 2019 - Dec 2019

PUBLICATIONS

- **"Real-time Sensor Anomaly Detection and Identification in Automated Vehicles."** IEEE Transactions on Intelligent Transportation Systems **[Paper]**
- **"Real-Time Sensor Anomaly Detection and Recovery in Connected Automated Vehicle Sensors."** IEEE Transactions on Intelligent Transportation Systems **[Paper]**
- **"Anomaly detection in connected and automated vehicles using an augmented state formulation."** 2020 Forum on Integrated and Sustainable Transportation Systems (FISTS) **[Paper]**
- **"Adversarial Online Learning with Variable Plays in the Pursuit-Evasion Game: Theoretical Foundations and Application in Connected and Automated Vehicle Cybersecurity."** IEEE Access **[Paper]**
- **"A Dynamic Deep Reinforcement Learning-Bayesian Framework for Anomaly Detection."** IEEE Transactions on Intelligent Transportation Systems **[Paper]**
- **"Anomaly Detection and String Stability Analysis in Connected Automated Vehicular Platoons."** Transportation Research Part C **[Paper]**
- **"Improving Transit in Small Cities through Collaborative and Data-driven Scenario Planning."** Case Studies on Transport Policy **[Paper]**
- **"Cybersecurity in Connected and Automated Transportation Systems."** Ph.D. Thesis **[Paper]**
- **"Dynamic Security Resource Allocation for Connected and Automated Vehicles."** Transportation Research Part C **[Paper]**
- **"An Aggregation/Disaggregation Algorithm for Transit Route Planning Problem."** Working Paper

TALKS AND PRESENTATIONS

Dynamic Resource Allocation for Connected and Automated Vehicles' Cybersecurity.
- TRB Annual Meeting, Washington DC, Jan. 2024.

Anomaly Detection and String Stability Analysis in Connected Automated Vehicular Platoons.
- INFORMS Annual Conference, Phoenix, AZ, Oct. 2023.
- TRB Annual Meeting, Washington DC, Jan. 2023.
- Mcity Research Review, Ann Arbor, MI, Nov. 2022.
- Mcity's Cyber Working Group. Oct. 2022. (virtual)

- NGTS Seminar, Department of Civil and Environmental Engineering, University of Michigan, Ann Arbor, Sept. 2022.

Real-Time Sensor Anomaly Detection and Recovery in Connected Automated Vehicle Sensors.
- Bridging Transportation Researchers (BTR) Conference. Aug. 2022. (virtual)
- International Symposium on Transportation Data and Modelling, Ann Arbor, MI. Jun. 2021. (virtual)
- International Symposium on Transportation Data and Modelling, Ann Arbor, MI. June. 2020. (postponed)
- INFORMS Annual Conference, Seattle, WA, Oct. 2019.
- IAVSD Workshop on Dynamics of Road Vehicles Connected and Automated Vehicles, Ann Arbor, MI, Apr. 2019.
- NGTS Seminar, Department of Civil and Environmental Engineering, University of Michigan, Ann Arbor, Jan. 2019.

Anomaly Detection in Connected and Automated Vehicles Using an Augmented State Formulation.
- Forum on Integrated and Sustainable Transportation Systems (FISTS), Nov. 2020. (virtual)

Adversarial Online Learning with Variable Plays in the Evasion-and-Pursuit Game: Theoretical Foundations and Application in Connected and Automated Vehicle Cybersecurity.
- NGTS Seminar, Department of Civil and Environmental Engineering, University of Michigan, Ann Arbor, Oct. 2020. (virtual)

A Data-Driven Framework for Optimizing Transit Itineraries.
- 2019 Michigan Institute for Data Science Symposium, Ann Arbor, MI, Nov. 2019.

ACADEMIC SERVICES

Conference Reviewer:
- International Symposium on Transportation and Traffic Theory (ISTTT): 2025
- Transportation Research Board Annual Meeting (TRBAM): 2020 - 2024
- Bridging Transport Researchers Conference (BTR): BTR4
- IEEE International Conference on Intelligent Transportation Systems (ITSC): 2021 - 2020

Journal Reviewer:
- IEEE Network Magazine
- IEEE Sensors Journal (IEEE Sens. J.)
- IEEE Transactions on Intelligent Transportation Systems (IEEE T-ITS)
- IEEE Transactions on Vehicular Technology (IEEE TVT)
- Peer-to-Peer Networking and Applications
- Space: Science & Technology
- Wireless Communications and Mobile Computing

HONORS

- **William S. Housel Fellowship**, University of Michigan, Ann Arbor — Jan 2019 - Dec 2019
- **Outstanding Graduates Honer**, Jilin University — Apr 2016
- **Posts and Telecommunications Alumni Scholarship (top 2%)**, Jilin University — Sep 2015 - Apr 2016
- **Dong-Rong Scholarship (top 3%)**, Jilin University — Sep 2015 - Apr 2016
- **First Prize Scholarship (top 5%)**, Jilin University — Sep 2015 - Apr 2016
- **National Scholarship (top 1/91)**, Jilin University — Sep 2014 - Apr 2015
- **First Prize Scholarship (top 5%)**, Jilin University — Sep 2013 - Apr 2014

LEADERSHIP

Michigan Transportation Student Organization (MiTSO) | Treasurer
University of Michigan, Ann Arbor — Sep 2019 - Apr 2022

Michigan Transportation Student Organization (MiTSO) | Secretary
University of Michigan, Ann Arbor — Sep 2019 - Apr 2020