Wissam Kontar

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Overarching Goal

Transportation systems are ever-evolving, dynamic, and complex. Self-driving vehicles and emerging modes of transportation (electric vehicles, electric bikes, electric scooters) are becoming more powerful and rapidly infiltrating the global market. As such, a new dimension of complexity is disrupting our transportation system, one that comes from heterogeneity in behavior, performance, and design. My research focuses on guiding the development and deployment of emerging transportation technologies in ways that are not myopic but consider system-level performance and ensure sustainability.

Education

University of Wisconsin-Madison **August 2022**
Ph.D., Civil and Environmental Engineering, Doctoral Minor: Computer Sciences
Transportation Operation & Safety Lab (TOPS), Sustainability & Emerging Technology Lab
Thesis: *Multi-class Automated Vehicles: Connecting Control Dynamics to Traffic Level Understanding & Enabling Strategic Decision Making*
Advisors: Professor Soyoung Ahn, Professor Andrea Hicks

American University of Beirut **August 2018**
B.E., Civil and Environmental Engineering, Minor: Mathematics
Thesis: *3-D Printed Concrete Structures*

Research Interests

Automated Vehicles, Transportation Analysis, Intelligent Transportation Systems, Federated Data Analytics, Environmental Modeling, Sustainable Mobility

1. Systems Control for Automated Vehicles (AVs):
Building analysis frameworks to unveil system-level performance of commercial vehicle automation features.
2. Real-world Performance of AV Control:
Developing bayesian methods and algorithms to safeguard AVs against real-world complex uncertainties, and ensure traffic-level performance.
3. Transportation Environmental Sustainability:
Unveiling hidden and non-linear environmental implications associated with emerging transportation modes, mobility electrification, and technology adoption patterns. Developing Life Cycle Assessment (LCA) techniques for calculating emission factors of transportation modes during their life cycle.
4. Federated Analytics:
Studying application frameworks of harnessing the processing and computation power of the Internet of Things (IoT) edge devices to benefit transportation operations through the lens of federated learning.

Awards & Honors

1. Rising Star in Cyber-Physical Systems (CPS) - Sponsored by National Science Foundation (NSF) May 2022
2. Journal Article Featured by IEEE Access Jan. 2022
3. Journal Article is in Top 5% Attracting Attention - Media Coverage by Popular Science, Gizmodo, Politico, Others. Aug. 2021
4. Campus-Wide Teaching Award for Innovation in Teaching (Nominated) Oct. 2022

5. Student Research Grants Competition (Awarded) - Wisconsin Scholarship Hub Dec. 2021

Proposal Writing & Funding

Center for Transportation Equity, Decisions & Dollars (CTEDD-USDOT): *Emission Calculator for Emerging Modes of Transportation* - $ 50,000

Network for Digital Economy and the Environment (nDEE): *Autonomous Ridesharing Vehicles and the Environmental Rebound Effect* - $ 50,000

Center for Transportation Equity, Decisions & Dollars (CTEDD-USDOT): *E-bike Sharing and the Infrastructure Implications and Environmental Impacts of New Technology in Transportation Systems* - $ 97,000

Publications

Journal Papers

[*J*1] **W. Kontar**, E. Bulson, S. Ahn, A. Hicks."Would you change your travel mode if you knew its carbon footprint?". In preparation, Jan. 2022.
[*J*2] A. Hicks, **W. Kontar**."The role of disasters and infrastructure failures in engineering eduction with analysis through machine learning". Under review, *Environmental Research Sustainability and Infrastructure*, Jan. 2023.
[*J*3] Y. Zhou, **W. Kontar**, A. Srivastava, S. Ahn. "Traffic Wave Propagation for Automated Vehicles: Theory and Analytical Properties". In preparation, *Transportation Research Part B: Methodological*, Oct. 2022.
[*J*4] **W. Kontar**, A. Srivastava, S. Ahn. "Learning and Predicting Multi-class Automated Vehicle Behavior". In preparation, Oct. 2022
[*J*5] **W. Kontar**, S. Ahn. "Bayesian Methods in Automated Vehicle's Car-following Uncertainties: Enabling Strategic Decision-Making". Under review, *Transportation Research Part C: Emerging Technologies*, Oct. 2022.
[*J*6] **W. Kontar**, S. Ahn, A. Hicks. "Transportation Emissions During Pandemic: Duality of Impacts". *Environmental Research Infrastructure and Sustainability*, Sept. 2022.
[*J*7] **W. Kontar**, S. Ahn, A. Hicks. "Electric Bicycles Sharing: Opportunities and Environmental Impacts". *Environmental Research Infrastructure and Sustainability*, August. 2022.
[*J*8] R. Kontar, N. Shi, X. Yue, S. Chung, E. Byon, M. Chowdhury, J. Jin, **W. Kontar**, N. Massoud, M. Noueihed, C.E. Okwudire, G. Ravish, R. Saigal, K. Singh, Z. Ye. "The Internet of Federated Things (IoFT)". *IEEE Access, November. 2021.*
[*J*9] **W. Kontar**, T. Li, A. Srivastava, Y. Zhou, D. Chen, S. Ahn. "On Multi-class Automated Vehicles: Car-following Behavior and its Implication for Traffic Dynamics". *Transportation Research Part C: Emerging Technologies*, July. 2021. ***Presented at the 24th International Symposium on Transportation and Traffic Theory (ISTTT24)***
[*J*10] **W. Kontar**, S. Ahn, A. Hicks. "Autonomous Vehicle Adoption: Use Phase Environmental Implications". *Environmental Research Letters*, May. 2021.
[*J*11] A. Hicks, S.T. Sekeryan, **W. Kontar**, R. Ghamin, M.R. Morris. "Personal Respiratory Protection and Resiliency in a Pandemic, the Evolving Disposable Versus Reusable Debate and its Effect on Waste Generation". *Resources, Conservation and Recycling*, May. 2021.

Conference Papers

[*C*1] **W. Kontar**, S. Ahn. "Estimation of Autonomous Vehicles Vehicular Dynamics Uncertainties: A Real-time Approach". *Transportation Research Annual Meeting*, Jan. 2022.
[*C*2] N. Li, R. Fischer, **W. Kontar**, S. Ahn. 'Predicting Vehicle's Longitudinal Trajectories and Lane Changes on Highway On-Ramps". *Transportation Research Annual Meeting*, Jan. 2022.
[*C*3] N. Li, A.Z. Fan, R. Fischer, **W. Kontar**, B. Ran. "A Prioritized Trajectory Planning Algorithm for Connected and Automated Vehicles Mandatory Lane Changes". *IEEE International Conference on Intelligent Transportation*, Sept. 2021.
[*C*4] **W. Kontar**, S. Ahn. "Real-time Monitoring of Autonomous Vehicle's Time Gap Variations: A Bayesian

Framework". *Transportation Research Annual Meeting*, Jan. 2021.

Technical Reports

[*R*1] **W. Kontar**, E. Perry, S. Ahn, G. Vohres, Y. Han. "Freight Data Inventory and Training". Mid-American Freight Coalition (MAFC). Jan. 2019
[*R*2] Y. Han, **W. Kontar**, G. Vohres, E. Perry, S. Ahn. "Assessment of Multimodal (Marine and Highway) Bottlenecks in the MAASTO Region". Mid-American Freight Coalition (MAFC). Jan. 2019

Research Leadership Experience

Commercial Adaptive Cruise Control (ACC) Technologies Experimental Analysis:
An exhaustive effort to analyze the performance of ACC vehicles available in the market. Developed methodological research framework to analyze, predict and assess their performance in real-life settings. It concluded with lessons learned and strategies to enhance ACC and vehicle automation operations in traffic systems.

Adoption Patterns of Autonomous Vehicles & Electric Bicycles:
Led a collaborative research effort across the industry (BCycle), government (DOT, Madison), and academia (UW-Madison) to collect survey data on usage patterns of emerging transportation technologies. Ran survey design, data collection, and analysis efforts with a team of graduate and undergraduate students. Surveys were sent out to thousands across Madison city and the US.

Emission Calculator Software for Modes of Transportation:
I have led the development of an emission calculator software that gives travelers real-time knowledge on how much emissions are generated with their travel mode choices. The tool is currently in the product testing stage and is being used to encourage travelers to use less carbon-intensive modes of transportation.

Freight Data Training and Inventory:
Worked with Department of Transportation (DOT) leadership across 10 U.S states (Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Ohio, and Wisconsin) to develop a freight data repository. This repository is now a standard tool that helps stakeholders research and develop freight modal analysis.

Research Outreach

Interviews & Media Coverage:
Popular Science Magazine: *"Driverless Cars could curb public transit"*
Gizomodo: *"How Driverless Cars Could Lead to More Pollution"*
Physics Org: *"The environmental trade-offs of autonomous vehicles"*
Politico: *"Self-driving EVs could spike C02"*
Science Tech Daily: *"Convenience Will Likely Come at a Cost"*

Selected Invited Talks and Presentations:
Society of Environmental Toxicology and Chemistry (SETAC) (2022): *"The Promise of Sustainable Transportation: An Environmental Investigation of Emerging Transportation Technology"*.
24th International Symposium on Transportation and Traffic Theory (ISTTT) (2021): *"Multi-class Automated Vehicles"*.
TRB Committee on Traffic Flow Theory (2021): *"Multi-class Automated Vehicles and Traffic Implications"*.

Service

Internal Service:
Faculty search committee member (2022): hire for automated transportation systems through PVLs # 245331 & 255280
Graduate Student Council (2019-2022): Represented CEE graduate and undergraduate students. Voiced student concerns to faculty, university leadership, and academic departments.

Organizations Service:
President of Institute of Transportation Engineers UW-Madison Student Chapter (2020-2022)
President of Lebanese Student Association at UW-Madison (2020-2022)
Member at IEEE Intelligent Transportation Systems Committee
Member at TRB standing committee on Traffic Flow Theory and Characteristics
Journal & Conference Reviewer:
IEEE Intelligent Transportation Systems (2019-2022)
International Transportation Systems Conference (ITSC) (2021)
International Symposium on Transportation and Traffic Theory (ISTTT) (2022)
Transportation Research Part C: Emerging Technologies (2019-2022)
Transportation Research Part B: Methodological (2022)
Transportation Research Record (2019-2022)
Environmental Research Letters (2020-2022)
Society of Environmental Toxicology and Chemistry (SETAC) (2022)
Seminars:
Co-organizer of UW-Madison transportation technology seminar series
Workshop Organization
Co-organizer of "Recent Advances in Sel-Driving Vehicles: A Look at the Technology", Engineering EXPO, UW-Madison, 2022