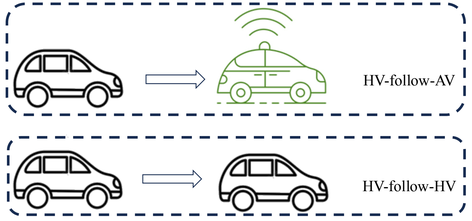
Transportation Behavioral Psychology & Safety Lab
心路同行 安全相随 • Mindful Journey, Safe Passage

Driver Behaviors in Mixed Traffic

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY (GUANGZHOU)

Background

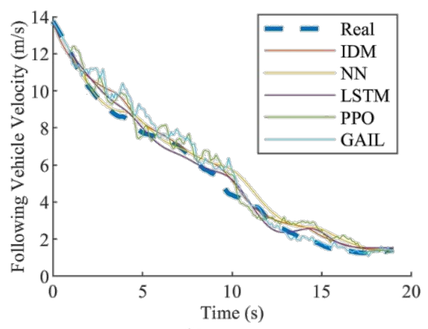
- Autonomous vehicles (AVs) and human-driven vehicles (HVs) will inevitably need to share public roads in the near future, leading to mixed traffic.
- Drivers may take different strategies to interact with AVs and HVs.
- It is necessary to take this difference into consideration when designing AV control algorithms.

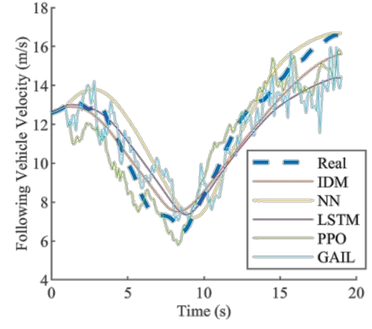


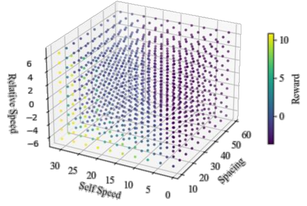
AVs commercially running in Nansha Guangzhou)

Car-Following Behavioral Modeling

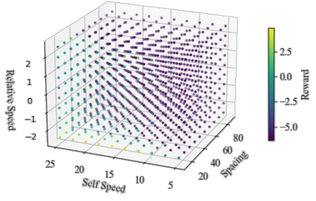
➢ Methodology:
- Statistical Models
  - Characterizing car-following behaviors when HV follows HVs versus AVs.
  - Hierarchical clustering
  - Principal component analysis (PCA)
  - Dynamic time warping (DTW)
- Deep learning (DL) and reinforcement learning (RL)
  - Extracting HVs strategies when interacting with HVs versus AVs.







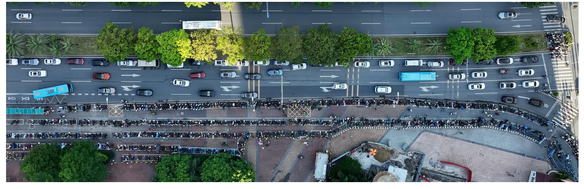
HV-follow-HV

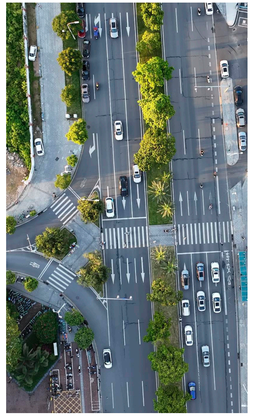


HV-follow-AV

Mixed Traffic Data Collection

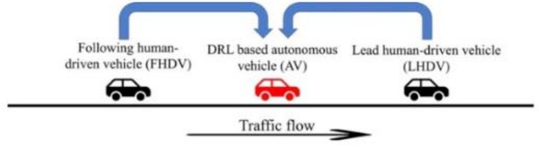
➢ Drone-based Data Collection and Analysis
- HV-HV interactions
- HV-AV interactions
- Behaviors of vulnerable road users

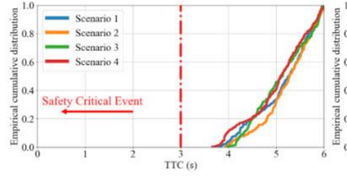




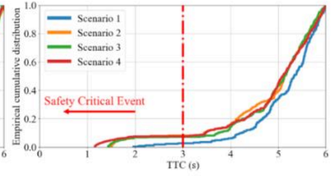
AV Control Algorithms with HV Behaviours Considered

➢ Preference-Based Reinforcement Learning





(a) AV-LHDV TTC



(b) FHDV-AV TTC

Publications

- Wen, X., Cui, Z., & Jian, S. (2022). Characterizing car-following behaviors of human drivers when following automated vehicles using the real-world dataset. Accident Analysis & Prevention, 172, 106689.
- Wen X., Jian S., He D. (2023). Modeling the effects of autonomous vehicles on human driver car-following behaviors using inverse reinforcement learning. IEEE Transactions on Intelligent Transportation Systems
- Wen X.., Huang C., Jian S., He D. (2023). Analysis of discretionary lane-changing behaviors of autonomous vehicles based on real-world data. Transportmetrica A: Transport Science.
- Wen X., Zheng X., Cui Z., Jian S., He D. (2024). Preference-based reinforcement learning for autonomous vehicle control considering the benefits of following vehicles. IEEE Transactions on Intelligent Vehicles.