

# Han Wang

Ph.D. in Autonomous Driving and Generative AI at Berkeley Artificial Intelligence Research

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## Profile and Objective

Ph.D. candidate at the Berkeley Artificial Intelligence Research group with a focus on Autonomous Driving and Generative AI. Seeking a postdoctoral position to further explore intelligent transportation systems and vehicular automation technologies.

## Education

<b>University of California, Berkeley</b>	<i>GPA 3.93/4.0</i>	<b>CA, United States</b>
Ph.D. in Transportation Engineering		08/2021 – 12/2024
M.S. in Electrical Engineering and Computer Science		08/2023 – 12/2024
M.Eng. in Transportation Engineering		08/2020 – 05/2021
Relevant Courses: Deep Reinforcement Learning / Responsible GenAI and Decentralized Intelligence / Advanced Control System / Reproducible and Collaborative Statistical Data Science / Computer Vision / Immersive Computing and Virtual Reality / Foundations of Computer Graphics / Intelligent Transportation Systems / Data Driven Control Methods for Civil Systems / Highway Traffic Operations / Operation of Transportation Facilities / Systems Analysis in Transportation / Public Transportation Systems / Traffic Safety and Injury Control		
<b>Southeast University</b>	<i>GPA 85.75/100</i>	<b>Nanjing, China</b>
M.Eng. in Transportation Engineering		09/2017 – 05/2020
<b>School of Transportation and Logistic, Southwest Jiaotong University</b>	<i>GPA 80.27/100</i>	<b>Chengdu, China</b>
B.S. in Transportation Engineering		09/2013 – 06/2017

## Research Experience

<b>Congestion Impacts Reduction via CAV-in-the-loop Lagrangian Energy Smoothing (CIRCLES)</b>	<b>03/2022-12/2024</b>
<i>World's largest open-track fieldtest, sending 100 auto-vehicle(AV)s to I-24 during the morning peak to improve traffic. Funded by Toyota, Nissan, and General Motors. Supported by Tennessee Department of Transportation</i>	
<ul style="list-style-type: none"><li>• <u>Role</u>: Led the centralized speed planner to publish the optimized speed for all 100 AVs in real-time during the experiment.</li><li>• <u>Tools</u>: RL Speed Planner: PyTorch, Ray, Gym   Backend: MySQL, Python   API: PHP</li><li>• <u>Outcome</u>: From the field test data, we observed an 8% improvement overall, with 7% and 10% improvements upstream and downstream, respectively, and a 52% improvement during congestion formation at the bottleneck.</li></ul>	
<b>Collision Indeterminacy Prediction via Stochastic Trajectory Generation</b>	<b>06/2023-06/2024</b>
<i>Predicting the motion of AV with the <b>pre-trained image generative model</b>. Funded by Berkeley Deep Drive and Allstate</i>	
<ul style="list-style-type: none"><li>• <u>Role</u>: Lead the occupancy image dataset collecting, generative decoder pre-training, end-to-end training with perception encoder, the building of the simulation platform, and the design &amp; training of the AV controller in the simulator.</li><li>• <u>Tools</u>: ML Model Design &amp; Training: PyTorch, Ray   Simulation: SUMO   Dataset: Argoverse</li><li>• <u>Outcome</u>: Developed a probabilistic occupancy risk assessment (PORA) metric, validated through a scenario-generation-based microsimulation platform, demonstrated to be effective in predicting 87% of the conflicts that could not be predicted by TTC-2.</li></ul>	
<b>Creating an Inclusive Bicycle Level of Service: Virtual Bicycle Simulator study</b>	<b>01/2021-08/2023</b>
<i>Gather user feedback on biking environments with <b>VR simulator</b> survey. Funded by California Department of Transportation</i>	
<ul style="list-style-type: none"><li>• <u>Role</u>: Built the VR biking simulator, including hardware &amp; software integration. Rebuilt the California streets in 3D scenarios.</li><li>• <u>Tools</u>: Simulator Development: Unity, C#, SteamVR   Modeling: Blender</li><li>• <u>Outcome</u>: The feedback from the survey proved the VR simulator provided a more realistic and engaging experience for participants, which enhanced their ability to make informed decisions about their route preferences.</li></ul>	
<b>Opportunities and Challenges for Runtime Behavior Generation in Games and Simulations</b>	<b>09/2023-06/2024</b>
<i><b>Runtime behavior generation</b> using large language models in game/simulation development. Personal Project</i>	
<ul style="list-style-type: none"><li>• <u>Role</u>: Developed the runtime code compile module. Implemented the semantic search and prompt engineering of the agent. Develop the element tree system of test scenarios. Conducted generalization tests in various scenarios.</li><li>• <u>Tools</u>: System Development: Unity, C#   LLM: OpenAI API</li><li>• <u>Outcome</u>: The pressure test demonstrated the system in various game scenarios, achieving an 85% success rate. Thematic analysis of developer feedback indicates the improved dynamic game experience by integrating real-time behavior generation.</li></ul>	

## V2X-based Driving Perception Assistance System

09/2023-12/2024

*Integration of foundation models and AR to enhance driving assistance systems via real-time visual aids* *Personal Project*

• **Role:** Designed and implemented a system integrating multimodal data (Lidar, cameras, maps, traffic updates) for real-time driving assistance. Developed AR visual aids for 3D object tracking and scene reconstruction. Utilized specialized LLMs for script generation and natural language interaction.

• **Tools:** System Development: Unity, C#, OpenCV | LLM: Ollama, LiteLLM

• **Outcome:** Achieved accurate 3D object tracking and reconstruction, enhancing driver situational awareness and safety through real-time AR visualizations. Refined functionality through human-in-loop interactions and driver feedback. Integrated foundation models for natural language command interpretation and script generation, improving the adaptability and usability.

## Vision-based Browser Automation using GenAI

01/2024-12/2024

*Automating browser workflows using multimodal LLM agents.*

*Personal Project*

• **Role:** Finetuned open-source LLMs with RAG for browser operation subtasks. Developed vision + HTML webpage scraper. Defined and implemented multi-agent workflow. Develop the browser operation API kit for LLM. Developed the Chrome extension for human-in-loop expert data collecting. Created the open dataset on HuggingFace.

• **Tools:** Finetune: Unsloth | Agent: Ollama, LangChain, LiteLLM

• **Outcome:** Enhanced automation stability and adaptability to website layout changes, enabling complex workflow automation across multiple sites. Integrated real-time debugging and visualization of automation steps, facilitating efficient troubleshooting.

## Skills

### Programming Languages:

Python, C#

### Backends:

MySQL, AWS

### Frameworks and Libraries:

PyTorch, Ray, Ollama, LiteLLM, Unsloth, OpenCV

### Simulation and Modeling:

Unity, SteamVR, Blender, SUMO

## Publications

- Lee, J. W., **Wang, H.**, Jang, K., Hayat, A., Bunting, M., Alanqary, A., ... (64 authors) & Bayen, A. M. (2024). Traffic control via connected and automated vehicles: An open-road field experiment with 100 cavs. Accepted by IEEE CSM Special Issue Sept. 2024. arXiv preprint arXiv:2402.17043.
- **Wang, H.**, Fu, Z., Lee, J., Matin, H. N. Z., Alanqary, A., Urieli, D., ... (17 authors) & Monache, M. L. D. (2024). Hierarchical speed planner for automated vehicles: A framework for lagrangian variable speed limit in mixed autonomy traffic. Accepted by IEEE CSM Special Issue Sept. 2024. arXiv preprint arXiv:2402.16993.
- **Wang, H.**, Nick Zinat Matin, H., & Delle Monache, M. L. (2024, June). Reinforcement learning-based adaptive speed controllers in mixed autonomy condition. In 2024 European Control Conference (ECC) (pp. 01-06). IEEE.
- Chekroun, R., **Wang, H.**, Lee, J., Toromanoff, M., Hornauer, S., Moutarde, F., & Monache, M. L. D. (2024). Mesoscale Traffic Forecasting for Real-Time Bottleneck and Shockwave Prediction. arXiv preprint arXiv:2402.05663.
- Fu, Z., Kreidieh, A. R., **Wang, H.**, Lee, J. W., Delle Monache, M. L., & Bayen, A. M. (2023, June). Cooperative driving for speed harmonization in mixed-traffic environments. In 2023 IEEE Intelligent Vehicles Symposium (IV) (pp. 1-8). IEEE.
- **Wang, H.**, Wu, H., Lu, J., Tang, F., & Delle Monache, M. L. (2023, September). Communication Optimization for Multi-agent Reinforcement Learning-based Traffic Control System with Explainable Protocol. In 2023 IEEE 26th International Conference on Intelligent Transportation Systems (ITSC) (pp. 6068-6073). IEEE.
- **Wang, H.**, & Delle Monache, M. L. (2022, July). Urban network resilience analysis and equity emphasized recovery based on reinforcement learning. In 2022 European Control Conference (ECC) (pp. 01-06). IEEE.
- Zhang, J., Dong, S., Li, Z., Ran, B., Li, R., & **Wang, H.** (2019). An eco-driving signal control model for divisible electric platoons in cooperative vehicle-infrastructure systems. IEEE Access, 7, 83277-83285.
- Tang, F., Cheng, L., **Wang, H.**, Mao, P., & Jiang, J. (2019). Research on the Impact of Car-Hailing on Travel Mode Choice: Evidence from Chengdu, China. In CICTP 2019 (pp. 6134-6145).
- Dong, S. Y., Zhang, J., **Wang, H.**, Ran, B., & Tan, H. C. (2018, July). A speed guidance-based signal control method for divisible platoon in CVIS. In 2018 IEEE 8th Annual International Conference on CYBER Technology in Automation, Control, and Intelligent Systems (CYBER) (pp. 1403-1408). IEEE.
- Dong, S. Y., Zhang, J., Chen, T. Y., **Wang, H.**, & Ran, B. (2018, July). CVIS-Based Intersection Signal Control Model for Indivisible Platoons. In 18th COTA International Conference of Transportation Professionals (pp. 359-368). Reston, VA: American Society of Civil Engineers.