Haoming Wang

Ph.D. Candidate, Electrical and Computer Engineering

Contact Information

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Research Interests

My research focuses on **physical AI systems** that perceive and reason about dynamic environments and interact autonomously with the surrounding entities. Specifically, it aims to enable **spatial intelligence** for physical AI systems, allowing effective 3D spatial representation and reasoning in today's **vision-language models** about the geometry and dynamics of the physical world. To support these capabilities, my research develops benchmarks and diagnostic methods to understand the VLM's spatial reasoning failures, and **generative AI algorithms** that improve multi-view integration and latent spatial representations. My research also integrates efficient **on-device AI systems** for the AI model's **online adaptation and self-evolution**, hence connecting AI model design to practical system deployment on resource-constrained platforms.

Education

University of Pittsburgh Sept. 2022 - May 2027 (expected)
Ph.D., Electrical and Computer Engineering
Advisor: Prof. Wei Gao, Intelligent System Lab

Zhejiang University Sept. 2018 - May 2022
B.Eng., Automation
Chu Kochen Honors College

Selected Publications

1. **[NeurIPS'26 Spotlight] Uncovering and Shaping the Latent Representation of 3D Scene Topology in Vision-Language Models**
   Haoming Wang, Wei Gao.
   Conference on Neural Information Processing Systems (NeurIPS), 2026 (Acceptance: **25.7%**; Spotlight: **1.32%**).
2. **[MobiCom'26] SpatialMind: Spatially Aware On-Device Embodied AI via Viewpoint Integration**
   Haoming Wang, Qiyao Xue, Weichen Liu, Boyuan Yang, Xiangyu Yin, Wei Gao.
   ACM International Conference on Mobile Computing and Networking (MobiCom), 2026 (Acceptance: **14.2%**).
3. **[ECCV'26] Reasoning Path and Latent State Analysis for Multi-view Visual Spatial Reasoning: A Cognitive Science Perspective**
   Qiyao Xue, **Haoming Wang (co-first)**, Weichen Liu, Shiqi Wang, Yuyang Wu, Wei Gao.
   European Conference on Computer Vision (ECCV), 2026 (Acceptance: **27.5%**).
4. **[CVPR'26 Oral] InfiniBench: Infinite Benchmarking for Visual Spatial Reasoning with Customizable Scene Complexity**
   Haoming Wang, Qiyao Xue, Wei Gao.
   IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2026 (Acceptance: **25.4%**; Oral: **0.88%**).
5. **[MobiCom'25] When Device Delays Meet Data Heterogeneity in Federated AIoT Applications**
   Haoming Wang, Wei Gao.
   ACM International Conference on Mobile Computing and Networking (MobiCom), 2025 (Acceptance: **17.1%**).
6. **[MobiSys'25] Never Start from Scratch: Expediting On-Device LLM Personalization via Explainable Model Selection**
   Haoming Wang, Boyuan Yang, Xiangyu Yin, Wei Gao.
   ACM International Conference on Mobile Systems, Applications, and Services (MobiSys), 2025 (Acceptance: **18.0%**).

7. **[AAAI'25] Tackling Intertwined Data and Device Heterogeneities in Federated Learning with Unlimited Staleness**
Haoming Wang, Wei Gao.
AAAI Conference on Artificial Intelligence, 2025 (Acceptance: **23.4%**).

Additional Publications and Manuscripts

8. **[SenSys'27] HEVEN: Small Object Search and Navigation on VLM-Based Autonomous Mobile Systems**
Chen Bian, Shuyao Shi, **Haoming Wang**, Qiyao Xue, Jingfei Xia, Jiahe Cui, Wei Gao, Guoliang Xing, Zhenyu Yan.
ACM/IEEE International Conference on Embedded Artificial Intelligence and Sensing Systems (SenSys), 2027
9. **[ECCV'26 Workshop] FreezeAsGuard: Mitigating Illegal Adaptation of Diffusion Models via Selective Tensor Freezing**
Kai Huang, **Haoming Wang (co-first)**, Wei Gao.
LifeGenIP Workshop at the European Conference on Computer Vision (ECCV), 2026.
10. **[In Submission] WorldMind: Test-Time Scaling for Visual Spatial Reasoning through Latent World Simulation**
Haoming Wang, Yongjian Fu, Ju Ren, Wei Gao.
11. **[In Submission] PanoNav: An Infrastructure-Assisted Mobile System for Daily Object Navigation via Multi-view VLM Reasoning**
Jingfei Xia, **Haoming Wang**, Yuting He, Shuyao Shi, Chen Bian, Jiahe Cui, Yurun Yang, Wei Gao, Guoliang Xing, Zhenyu Yan.
12. **[Preprint] Spatial Reasoning in Multimodal Large Language Models: A Survey of Tasks, Benchmarks and Methods**
Weichen Liu, Qiyao Xue, **Haoming Wang**, Xiangyu Yin, Boyuan Yang, Wei Gao.
2025. arXiv:2511.15722.
13. **[Preprint] Deciphering Personalization: Towards Fine-Grained Explainability in Natural Language for Personalized Image Generation Models**
Haoming Wang, Wei Gao.
2025. arXiv:2511.01932.

Public Speaking

Research Seminars

1. **Scaling Visual Spatial Reasoning at Inference Time**
Computer Science Department, Carnegie Mellon University 2025
2. **Towards Spatial Intelligence in Vision Language Models**
Computer Science Department, University of Virginia 2026

Conference Talks

3. **SpatialMind: Spatially Aware On-Device Embodied AI via Viewpoint Integration**
ACM MobiCom, Austin, TX, USA Oct. 2026
4. **InfiniBench: Infinite Benchmarking for Visual Spatial Reasoning with Customizable Scene Complexity**
IEEE/CVF CVPR (Oral Presentation), Denver, CO, USA June 2026
5. **When Device Delays Meet Data Heterogeneity in Federated AIoT Applications**
ACM MobiCom, Hong Kong, China Nov. 2025
6. **Never Start from Scratch: Expediting On-Device LLM Personalization via Explainable Model Selection**
ACM MobiSys, Anaheim, CA, USA June 2025

Teaching Experience

Course Co-Instructor ECE, University of Pittsburgh

ECE 1175: Embedded Systems Design Spring 2026; Fall 2026
Undergraduate course covering embedded computing architectures and operating systems with hands-on programming laboratories.

Responsibilities

- Delivered lectures on recent research in embedded systems.

- Designed a hands-on lab in which students built an embedded sensing system using a Raspberry Pi and sensors.
- Mentored students in embedded programming labs, helping them debug timing and hardware–software integration issues.

ECE 2195: Special Topics—Edge Computing Spring 2024
Graduate course covering edge computing architectures, software systems, and AI applications.

Responsibilities

- Led research paper discussions on edge AI and advised students on their projects.

Teaching Assistant ECE, University of Pittsburgh

ECE 2570: Robotic Control Spring 2026
Mentored students in labs on simulating control systems with Simulink.

ECE 1396: Introduction to Machine Learning Fall 2025
Mentored students in Python labs on implementing basic machine learning algorithms.

ECE 1195: Advanced Digital Design Spring 2025
Mentored students in CPU design labs using VHDL.

ECE 1175: Embedded System Design Fall 2024
Delivered lectures and mentored students in lab sessions.

PROPOSAL WRITING

Advancing Telemedicine in Pulmonology: Acoustic-Waveform Respiratory Evaluation (AWARE) via Sensing and Machine Learning on Smartphones
National Institutes of Health; proposal number: R01HL170368; total award: $3,135,287.
Award period: May 2024 - April 2029. PIs: Wei Gao and Erick Forno.
Role: Major proposal contributor; listed as senior personnel.

Software Hardware Architecture Co-Design for Enabling True Virtual Reality on Mobile Devices
National Science Foundation; proposal number: CCF-2215042; total award: $600,000.
Award period: July 2022 - June 2025. PI: Wei Gao.
Role: Major proposal contributor; listed as senior personnel.

STUDENT ADVISING

Shiqi Wang (Pitt) Ph.D., 2025–2030	Guided the design of an AI agent's workflow for myocardial infarction diagnosis and helped revise the manuscript.
Keshav Shankar (Pitt) Ph.D., 2025–2030	Guided the formulation of the gaze-based intent prediction task and advised on implementing a vision-language model on a mobile platform.
Xirui Liu (Pitt) Ph.D., 2026–2031	Advised on the fundamentals of multimodal representations and training dynamics, and discussed how they relate to cognitive science.

PROFESSIONAL SERVICE

Program Committee: ACM S3 Workshop (2026).

Conference Reviewing: ICLR 2027; NeurIPS 2026 (**Top Reviewer**); Pacific Graphics 2026.

Journal Reviewing: *IEEE Transactions on Pattern Analysis and Machine Intelligence* (TPAMI); *IEEE Transactions on Computers* (TC); *IEEE Transactions on Mobile Computing* (TMC); *ACM Transactions on Internet of Things* (TIOT).

HONORS AND AWARDS

Spotlight Paper
Conference on Neural Information Processing Systems (NeurIPS) 2026

Oral Paper
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) 2026

ECE Research Assistant of the Year
Department of Electrical and Computer Engineering, University of Pittsburgh 2026