Haozhe Lei

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Homepage

EDUCATION

New York University　　　　　　　　　　　　　　　　　　　　Sept. 2022 – Present
Ph.D. in Electrical and Computer Engineering
Advisor: Prof. Sundeep Rangan, Director, NYU Wireless
Award: 2023 Ernst Weber Fellowship

New York University　　　　　　　　　　　　　　　　　　　　Sept. 2020 – May 2022
M.S. in Computer Engineering

China Agricultural University　　　　　　　　　　　　　　　　Sept. 2015 – Jun. 2019
B.E. in Electrical Engineering and Automation

RESEARCH INTERESTS

- **Methods:** RF sensing, ISAC inference, multimodal scene graphs, foundation-model agents, embodied reasoning, physics-informed RL, neuro-symbolic RL
- **Systems and Applications:** indoor localization & navigation, wireless robotics, closed-loop autonomy, multi-band UE connectivity, beam and antenna coordination, radar odometry, object detection

RESEARCH EXPERIENCE

NYU Wireless　　　　　　　　　　　　　　　　　　　　　　　*Brooklyn, NY, USA*
Research Assistant　　　　　　　　　　　　　　　　　　　　　*Sept. 2022 – Present*

Research at the intersection of **wireless sensing/ISAC, multimodal spatial reasoning, and wireless robotics**.

- **Multimodal spatial reasoning**: Developing a *scene-graph* representation pipeline that fuses egocentric vision with wireless cues to learn graph-structured indoor embeddings (nodes: places/objects; edges: spatial relations). Building VLM-driven agents over these structured representations for object search, spatial grounding, and human activity-aware reasoning.
- **Likelihood-based RF localization for ISAC**: Building a model-free posterior inference pipeline that maps raw radio signals to calibrated spatial *belief* distributions for downstream 6G decision-making (beam management, risk-aware control).
- **Navigation**: Physics-informed reinforcement learning and digital-twin methods for indoor navigation and SLAM, with publications in *ICRA, IEEE OJ-COMS*, and *RLC (Spotlight)*. Designed and built a **TurtleBot4**-based **FR3** wireless indoor navigation platform in **ROS2**; conducting expanded localization and navigation experiments on this platform.
- **Multi-band receiver/antenna switching**: Model-free, estimator-augmented **Transformer** for inference-driven, interference-aware antenna–band coordination in handheld UEs across mid/upper-mid/mmWave bands under high mobility (self-rotation, walking), with publications in *ICC*. Supports co-band or orthogonal sharing and subset selection; balances rate, energy, and switching cost in **3GPP**-compliant, ray-traced channels.

NYU C2SMARTER Center　　　　　　　　　　　　　　　　　　*Brooklyn, NY, USA*
Research Assistant　　　　　　　　　　　　　　　　　　　　　*Sept. 2023 – Mar. 2026*

- **Traffic mobility control**: Real-time mobility monitoring with adaptive camera-tilt control for fast detection/response (TR-C).
- **Digital-twin closed loop**: Integration of loop detectors and video analytics for mobility/safety risk prediction; validated on a Brooklyn urban testbed (IEEE T-ITS).

- **Safe adaptive control**: Neurosymbolic/meta-RL controllers for nonstationary driving and cyber–physical penetration testing; lookahead planning and fast adaptation (ICRA; MILCOM).
- **Routing control under strategic behavior**: Incentive-compatible route recommendation and robust policies against misinformation; risk assessment/mitigation (IEEE TIFS).

PUBLICATIONS

Legend: * co-first author, † corresponding author.

Journal Articles

[J1] Tao Li, **Haozhe Lei**, Hao Guo, Mingsheng Yin, Yaqi Hu, Quanyan Zhu, and Sundeep Rangan. "Digital Twin-Enhanced Wireless Indoor Navigation: Achieving Efficient Environment Sensing with Zero-Shot Reinforcement Learning". *IEEE Open Journal of the Communications Society* (2025).

[J2] Tao Li*, Zilin Bian*, **Haozhe Lei***, Fan Zuo*, Ya-Ting Yang*, Quanyan Zhu, Zhenning Li, Zhibin Chen, and Kaan Ozbay. "Digital Twin-Based Driver Risk-Aware Intelligent Mobility Analytics for Urban Transportation Management". *IEEE Transactions on Intelligent Transportation Systems* (2025).

[J3] Ya-Ting Yang, **Haozhe Lei**, and Quanyan Zhu. "PRADA: Proactive Risk Assessment and Mitigation of Misinformed Demand Attacks on Navigational Route Recommendations". *IEEE Transactions on Information Forensics and Security* (2025).

[J4] Zilin Bian, Tao Li, **Haozhe Lei**, Fan Zuo, Ya-Ting Yang, Quanyan Zhu, Zhenning Li, and Kaan Ozbay. "Multi-level Traffic-Responsive Tilt Camera Surveillance through Predictive Correlated Online Learning". *Transportation Research Part C: Emerging Technologies* (2024).

Conference Papers

[C1] Ruibin Chen*, **Haozhe Lei***,†, Hao Guo, Marco Mezzavilla, Hitesh Poddar, Tomoki Yoshimura, and Sundeep Rangan. "Transformer-Based Rate Prediction for Multi-Band Cellular Handsets". *IEEE International Conference on Communications (ICC)*. 2026.

[C2] Tao Li, **Haozhe Lei**, Mingsheng Yin, and Yaqi Hu. "Reinforcement Learning with Physics-Informed Symbolic Program Priors for Zero-Shot Wireless Indoor Navigation". *Reinforcement Learning Conference (RLC)*. selected as a spotlight paper. 2025.

[C3] **Haozhe Lei**, Yunfei Ge, and Quanyan Zhu. "ADAPT: A Game-Theoretic and Neuro-Symbolic Framework for Automated Distributed Adaptive Penetration Testing". *IEEE Military Communications Conference (MILCOM)*. 2024.

[C4] Mingsheng Yin*, Tao Li*, **Haozhe Lei***, Yaqi Hu, Sundeep Rangan, and Quanyan Zhu. "Zero-Shot Wireless Indoor Navigation through Physics-Informed Reinforcement Learning". *2024 IEEE International Conference on Robotics and Automation (ICRA)*. 2024.

[C5] Tao Li*, **Haozhe Lei***, and Quanyan Zhu. "Self-Adaptive Driving in Nonstationary Environments through Conjectural Online Lookahead Adaptation". *2023 IEEE International Conference on Robotics and Automation (ICRA)*. 2023.

ArXiv Preprints

[A1] Zhaoye Pan, **Haozhe Lei**, Fan Zuo, Zilin Bian, and Tao Li. *Distributed Online Convex Optimization with Nonseparable Costs and Constraints*. arXiv:2602.10452. 2026.

[A2] **Haozhe Lei**, Ya-Ting Yang, Tao Li, Zilin Bian, Fan Zuo, Sundeep Rangan, and Kaan Ozbay. *Traffic Adaptive Moving-window Service Patrolling for Real-time Incident Management during High-impact Events*. arXiv:2504.11570. 2025.

[A3] Ya-Ting Yang, **Haozhe Lei**, and Quanyan Zhu. *Adaptive Incentive-Compatible Navigational Route Recommendations in Urban Transportation Networks*. arXiv:2409.00236. 2024.

[A4] **Haozhe Lei** and Quanyan Zhu. *Neurosymbolic Meta-Reinforcement Lookahead Learning Achieves Safe Self-Driving in Non-Stationary Environments*. arXiv:2309.02328. 2023.

[A5] H. Lei and Q. Zhu. *Cognitive Level-k Meta-Learning for Safe and Pedestrian-Aware Autonomous Driving*. arXiv:2212.08800. 2023.

[A6] Tao Li, **Haozhe Lei**, and Quanyan Zhu. *Sampling Attacks on Meta Reinforcement Learning: A Minimax Formulation and Complexity Analysis*. arXiv:2208.00081. 2023.

[A7] Ya-Ting Yang[*], **Haozhe Lei**[*], and Quanyan Zhu. *Strategic Information Attacks on Incentive-Compatible Navigational Recommendations in Intelligent Transportation Systems*. arXiv:2310.01646. 2023.

Ongoing / Under Review

[W1] **Haozhe Lei**[†], Hao Guo, and Sundeep Rangan. *Wireless Localization via Likelihood-Based Posterior Inference*. Target venue: IEEE Transactions on Wireless Communications (journal). 2025.

[W2] **Haozhe Lei**[†], Hao Guo, Tommy Svensson, and Sundeep Rangan. *Beyond Point Estimates: Likelihood-Based Full-Posterior Wireless Localization*. arXiv:2509.25719. 2025.

TEACHING & MENTORING

New York University   Sept. 2024 – Present

Graduate Teaching

- ECE-GY5213 Introduction to System Engineering, Teaching Assistant   Spring 2024

Graduate Mentoring

- Ruibin Chen, Current Position: Ph.D. student at New York University
  Project: Antenna Switching in Multi-Band UEs with High Mobility   Feb. 2025 – Present
- Yuheng Liu, Current Position: M.S. student at New York University
  Project: Spatial Reasoning with Scene-Graph Embeddings and Agentic Inference   Jan. 2026 – Present

INTERNSHIPS

Astrabeam   *New York, NY, USA*
Research Intern   *Jun. 2025 – Aug. 2025*

- Doppler-based mmWave radar processing in ROS2 for odometry & object detection.

JD.com, Inc.   *Beijing, China*
Algorithm Engineer Intern   *Jan. 2021 – Feb. 2021*

- CenterNet (PIoU) rotational detection; on-site deployment to manufacturing lab.

AWARDS

- Ernst Weber Fellowship (NYU Tandon School of Engineering), 2023
- School of Engineering Fellowship (NYU Tandon School of Engineering), 2022
- Tandon Research Excellence Exhibit, Project: *AI-Driven Interactive Safe Autonomous Driving*, 2022
- Mathematical Contest in Modeling (S Prize), 2018
- Beijing Higher Education Association Mathematical Contest, Second Prize, 2017
- China National University Student Innovation & Entrepreneurship Training Program, Project: *Research on Smart Home Household Intelligent Power Grid Management System*, 2017-2019

TECHNICAL EXPERTISE

- **Programming & Tools:** Python, Linux/Shell scripting, MATLAB, R, LaTeX, Kubernetes (HSRN cluster)
- **Simulation & Frameworks:** ROS2, Sionna, Remcom (Wireless), SUMO & CARLA (Transportation)

- **Robotics & Wireless Hardware:** Turtlebot4, TI mmWave radar (AWR1642, AWR6843), DCA1000

REVIEW SERVICES

Journals

- IEEE Transactions on Communications (TCOM)
- IEEE Wireless Communications Letters (WCL)
- IEEE Vehicular Technology Magazine (VTM)
- IEEE Control Systems Letters (L-CSS)

Conferences

- IEEE International Conference on Communications (ICC 2026)
- IEEE International Conference on Computer Communications (INFOCOM 2025)
- IEEE Global Communications Conference (GLOBECOM 2025)
- IEEE Conference on Decision and Control (CDC 2025)
- IEEE International Conference on Robotics and Automation (ICRA 2024)
- American Control Conference (ACC 2024)

REFERENCES

- **Prof. Sundeep Rangan** – Director, NYU Wireless; Professor, Electrical and Computer Engineering, NYU Tandon
- **Prof. Ludovic Righetti** – Professor, Electrical and Computer Engineering & Mechanical and Aerospace Engineering, NYU Tandon; International Chair, Artificial and Natural Intelligence Toulouse Institute
- **Prof. Chen Feng** – Associate Professor, Civil and Urban Engineering & Mechanical and Aerospace Engineering & Computer Science and Engineering, NYU Tandon
- **Prof. Marco Mezzavilla** – Associate Professor, Electronics, Information and Bioengineering, Politecnico di Milano
- **Dr. Hao Guo** - Lead Wireless Solutions Architect, CableLabs