Liangkai Liu

Research Fellow, University of Michigan

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Research Interests

Computing Systems for Autonomous Driving, Cyber-Physical Systems, Edge Computing, Robotics.

Experience

- University of Michigan — *September 2023 - Present*
  Research Fellow — Ann Arbor, MI, USA
  ◦ Mentor: Prof. Kang G. Shin

- University of Delaware — *May 2023 - August 2023*
  Postdoctoral Researcher — Newark, DE, USA
  ◦ Mentor: Prof. Weisong Shi

- Argonne National Laboratory — *May 2021 - August 2021*
  Research Intern — Lemont, IL, USA

- Argonne National Laboratory — *May 2020 - August 2020*
  Research Intern — Lemont, IL, USA

Education

- Wayne State University — *January 2018 - May 2023*
  Ph.D. in Computer Science — Detroit, MI, USA
  ◦ Advisor: Prof. Weisong Shi
  ◦ Dissertation: *Predictable DNN Inference for Autonomous Driving.*

- Xidian University — *August 2013 - June 2017*
  B.S. in Telecommunication Engineering — Xi'an, China

Awarded Grant

- **NSF CSR: Small: Predictable Multi-Tenant DNN Inference for Autonomous Driving**
  PI: Weisong Shi
  My Role: **Co-Principal Investigator** (My share: $300,000)
  Awarded amount: $600,000 (10/1/2024 - 9/30/2027)
  Grant number: **2343601**

- **General Motors: I-SEE: Intelligent Vehicular Perception and Control**
  PI: Kang G. Shin
  My Role: **Project Leader**
  Awarded amount: $155,000 (7/1/2025 - 12/31/2026)

Publications
C=Conference, J=Journal, B=Book, S=In Submission

- Google Scholar (as of Nov. 2025): **2,600+** citations, H-Index: **19**, i10-Index: **22**.

- **26** research papers in prestigious conferences/journals, **15** first-authored papers.

- **1** book: *Computing Systems for Autonomous Driving*.

Conferences

[C20] Liangkai Liu, Jinkyu Lee, and Kang G. Shin, "RT-BEV: Enhancing Real-Time BEV Perception for Autonomous Vehicles," in *Proceedings of the IEEE Real-Time Systems Symposium (**RTSS**)*, 2024.
*CS Ranking, **top conference in Embedded & Real-Time Systems*

[C19] Chao Wu*, Yifan Gong*, **Liangkai Liu***, Mengquan Li, Yushu Wu, Xuan Shen, Zhimin Li, Geng Yuan, Weisong Shi, and Yanzhi Wang, "AyE-Edge: Automated Deployment Space Search Empowering Accuracy yet Efficient Real-Time Object Detection on the Edge," in *International Conference on Computer-Aided Design (**ICCAD**)*, 2024. (*Equal contribution)
*CS Ranking, **top conference in Design Automation*

[C18] Liangkai Liu, Ren Zhong, Aaron Willcock, Nathan Fisher, and Weisong Shi, "An Open Approach to Energy-Efficient Autonomous Mobile Robots," in *Proceedings of the IEEE International Conference on Robotics and Automation (**ICRA**)*, 2023.
*CS Ranking, **top conference in Robotics*

[C17] Liangkai Liu, Yanzhi Wang, and Weisong Shi, "Understanding Time Variations of DNN Inference in Autonomous Driving," in *MLSys Workshop on Benchmarking Machine Learning Workloads on Emerging Hardware (**MLBench**)*, 2023.
*NSF Award

[C16] Liangkai Liu, Zheng Dong, Yanzhi Wang, and Weisong Shi, "Prophet: Realizing a Predictable Real-time Perception Pipeline for Autonomous Vehicles," in *Proceedings of the IEEE Real-Time Systems Symposium (**RTSS**)*, 2022.
*CS Ranking, **top conference in Embedded & Real-Time Systems*

[C15] Liangkai Liu, Baofu Wu, and Weisong Shi, "A Comparison of Communication Mechanisms in Vehicular Edge Computing," in *USENIX Workshop on Hot Topics in Edge Computing (**HotEdge**)*, 2020.
*top conference in Edge Computing

[C14] Liangkai Liu, Yongtao Yao, Ruijun Wang, Baofu Wu, and Weisong Shi, "Equinox: A road-side edge computing experimental platform for CAVs," in *International Conference on Connected and Autonomous Driving (**MetroCAD**)*, 2020.

[C13] Liangkai Liu, Xingzhou Zhang, Qingyang Zhang, Andrew Weinert, Yifan Wang, Weisong Shi, "Auto-VAPS: An IoT-enabled public safety service on vehicles," in *Proceedings of the fourth workshop on international science of smart city operations and platforms engineering (**CPS-IoT Week**)*, 2019.
*part of NIST PSCR project

[C12] Liangkai Liu, Jiamin Chen, Marco Brocanelli, and Weisong Shi, "E2M: An Energy-Efficient Middleware for Computer Vision Applications on Autonomous Mobile Robots," in *ACM/IEEE Symposium on Edge Computing (**SEC**)*, 2019.
*top conference in Edge Computing

[C11] Liangkai Liu, Xingzhou Zhang, Mu Qiao, and Weisong Shi, "SafeShareRide: Edge-based Attack Detection in Ridesharing Services," in *ACM/IEEE Symposium on Edge Computing (**SEC**)*, 2018.
*top conference in Edge Computing

[C10] Liangkai Liu, Xingzhou Zhang, Mu Qiao, and Weisong Shi, "SafeShareRide: Edge-based Attack Detection in Ridesharing Services," in *USENIX Workshop on Hot Topics in Edge Computing (**HotEdge**)*, 2018.
*top conference in Edge Computing

[C9] Xingzhou Zhang, Yifan Wang, Sidi Lu, **Liangkai Liu**, Lanyu Xu, and Weisong Shi, "OpenEI: An Open Framework for Edge Intelligence," in *Proceedings of the IEEE International Conference on Distributed Computing Systems (**ICDCS**)*, 2019. (**150+ citations**)

[C8] Qingyang Zhang, Yifan Wang, Xingzhou Zhang, **Liangkai Liu**, Xiaopei Wu, Weisong Shi, and Hong Zhong, "OpenVDAP: An Open Vehicular Data Analytics Platform for CAVs," in *Proceedings of the IEEE International Conference on Distributed Computing Systems (**ICDCS**)*, 2018. (**120+ citations**)

[C7] Yifan Gong, Yushu Wu, Zheng Zhan, **Liangkai Liu**, Chao Wu, Xulong Tang, and Yanzhi Wang, "LOTUS: Learning-Based Online Thermal and Latency Variation Management for Two-Stage Detectors on Edge Devices," in *Design Automation Conference (**DAC**)*, 2024.
*CS Ranking, **top conference in Design Automation*

[C6] Abdullah Al Arafat, Sudharsan Vaidhun, **Liangkai Liu**, Kecheng Yang, and Zhishan Guo, "Compositional Mixed-Criticality Systems with Multiple Executions and Resource-Budgets Model," in *Proceedings of the IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**)*, 2023.
*CS Ranking, **top conference in Embedded & Real-Time Systems*

[C5] Sanjith Udupa, **Liangkai Liu**, and Weisong Shi, "FollowMe: A Robust Framework for the Guidance of Sensorless Indoor Mobile Robots," in *IEEE International Conference on Mobility, Operations, Services and Technologies (**MOST**)*, 2023.

[C4] Ren Zhong, **Liangkai Liu**, and Weisong Shi, "SLAM Sharing Among Heterogeneous Sensors," in *IEEE International Conference on Mobility, Operations, Services and Technologies (**MOST**)*, 2023.

[C3] Ruijun Wang, **Liangkai Liu**, and Weisong Shi, "HydraSpace: Computational data storage for autonomous vehicles," in *IEEE 6th International Conference on Collaboration and Internet Computing (**CIC**)*, 2020.

[C2] Xingzhou Zhang, Mu Qiao, **Liangkai Liu**, and Weisong Shi, "Collaborative Cloud-Edge Computation for Personalized Driving Behavior Modeling," in *ACM/IEEE Symposium on Edge Computing (**SEC**)*, 2019.
*top conference in Edge Computing

[C1] Yifan Wang, **Liangkai Liu**, Xingzhou Zhang, and Weisong Shi, "HydraOne: An Indoor Experimental Research and Education Platform for CAVs," in *USENIX Workshop on Hot Topics in Edge Computing (**HotEdge**)*, 2019.
*top conference in Edge Computing

Journals

[J6] **Liangkai Liu**, Sidi Lu, Ren Zhong, Baofu Wu, Yongtao Yao, Qingyang Zhang, and Weisong Shi, "Computing Systems for Autonomous Driving: State-of-the-Art and Challenges", in *IEEE Internet of Things Journal (**IoTJ**)*, Vol. 8, No. 8, pp. 6469-6486, December 2020. (**500+ citations**)

[J5] Shaoshan Liu, **Liangkai Liu**, Jie Tang, Bo Yu, Yifan Wang, and Weisong Shi, "Edge Computing for Autonomous Driving: Opportunities and Challenges," *Proceedings of the IEEE*, Vol. 107, No. 8, pp. 1697-1716, August 2019. (**900+ citations**)

[J4] **Liangkai Liu**, Yanzhi Wang, and Weisong Shi, "CPT: A Configurable Predictability Testbed for DNN Inference in AVs," in *Tsinghua Science and Technology*, September 2024.

[J3] **Liangkai Liu**, Wei Li, Dawei Wang, Yi Wu, Ruigang Yang, and Weisong Shi, "Fuel Rate Prediction for Autonomous Heavy-Duty Trucks," in *IEEE Transactions on Intelligent Transportation Systems (**TITS**), 2023*.
*top journal in Intelligent Transportation Systems

[J2] **Liangkai Liu**, Shaoshan Liu, and Weisong Shi, "4*C*: A Computation, Communication, and Control Co-Design Framework for CAVs," in *IEEE Wireless Communications (**IWC**)*, Vol. 28, No. 4, pp. 42-48, August 2021.
*top journal in Wireless Communications

[J1] Tianze Wu, Baofu Wu, Sa Wang, **Liangkai Liu**, Shaoshan Liu, Yungang Bao, and Weisong Shi, "Oops! It's Too Late. Your Autonomous Driving System Needs a Faster Middleware," *IEEE Robotics and Automation Letters (**RA-L**)*, Vol. 6, No. 4, pp. 7301-7308, July 2021.

Books

[B1] Weisong Shi and **Liangkai Liu**. *Computing Systems for Autonomous Driving*. November 2021, Springer.

In Submission

[S3] Liangkai Liu and Kang G. Shin, "MM-BEV: Enhancing Multi-Modality BEV Perception with LiDAR and Cameras", Under review.

[S2] Liangkai Liu and Kang G. Shin, "PIE: Patch-based Inference Engine for Predictable Deep Learning", Under review.

[S1] Liangkai Liu and Kang G. Shin, "eXR: A Power-Efficient Framework For XR", Under review.

Honors and Awards

- ACSIC SOFC 2025 Travel Grant Award   *2025*
  ACSIC

- Outstanding Conference Publication Award   *2023*
  Wayne State University

- RTSS Student Travel Grant   *2022*
  IEEE Real-Time Systems Symposium

- Outstanding Conference Publication Award   *2022*
  Wayne State University

- NSF ACM/IEEE Symposium on Edge Computing Travel Grant   *2021, 2019, 2018*
  National Science Foundation

- Top Ten Seniors Award   *2016*
  Xidian University

- First Prize, CETC-10 Literature Review Contest   *2016*
  CETC-10, Xidian University

Mentoring Experience

- Aaron Sequeira   *Mentored: 2025*
  Master student in ECE at University of Michigan

- Sanjith Udupa   *Mentored: 2022/2023*
  Novi High School student; now undergraduate at MIT   first-authored paper

- Mingyu Guo   *Mentored: 2023*
  Undergraduate at the University of Wisconsin–Madison; now Ph.D. at University of Delaware

- Yuchen Chueh   *Mentored: 2020*
  Admitted to Master's Program at Carnegie Mellon University, now at Nvidia

- Justin Baskaran   *Mentored: 2018*
  Backend Software Engineer at General Motors

INVITED TALKS

- DSL Seminar: Building Predictable and Efficient Computing Systems for Autonomous Driving   *2025*
  University of Pennsylvania, Autoware Center of Excellence Seminar

- Lightning Talk, 2025 NSF CSR Principal Investigator Meeting   *2025*
  Florida Atlantic University, Boca Raton, FL

- Guest lecture, Building Predictable and Power-Efficient Autonomous Cyber-Physical Systems   *2024*
  University of Michigan, Oakland University

- Guest lecture, Robot Platforms for CPS Research   *2024*
  University of Michigan, EECS-571

- Guest lecture, Building Predictable and Efficient System for Autonomous Vehicles/Robots   *2024*
  University of Michigan, University of North Texas, California Polytechnic State University

- Seminar talk: Introduction to Autonomous Driving   *2023*
  HensHack at University of Delaware

- Computing systems for connected and autonomous driving   *2022*
  UIUC physical AI group

- Teaching Assistant, Introduction to Java Programming   *2018*
  Wayne State University

PROFESSIONAL SERVICES

- Co-Chair, DroneSys: First Workshop on Autonomous Drone Computing Systems and Applications, 2025

- Grant proposal reviewer, AAPG 2025, French National Research Agency's (ANR)

- Publication Chair, ACM/IEEE Symposium on Edge Computing, 2025.

- Program Committee, IEEE Conference on Dependable and Secure Computing (DSC), 2025

- Program Committee, IEEE International Conference on Mobility: Operations, Services, and Technologies (MOST), 2024/2025/2026

- Program Committee, Workshop on Compute Platforms for Autonomous Vehicles (CAV), ASPLOS 2024

- Program Committee, The 21th ACM Conference on Embedded Networked Sensor Systems (SenSys 2023) Posters & Demos

- Reviewer, International Conference on Computer Vision (ICCV), 2025

- Reviewer, IEEE/CVF Computer Vision and Pattern Recognition Conference (CVPR), 2024/2025

- Reviewer, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2022/2023/2024

- Reviewer, IEEE International Conference on Robotics and Automation (ICRA), 2023/2025/2026

- Web Chair, MobiCom 2024

- Technical Steering Committee of the Autoware Foundation, October 2022 - December 2023

- Verified and Recognized Journal Reviewer: Nature Communications, IEEE Communications Magazine, Proceedings of the IEEE, IEEE Transactions on Vehicular Technology, IEEE Vehicular Technology Magazine, IEEE Transactions on Services Computing, IEEE Internet of Things Journal, IEEE Network Magazine, IEEE Internet Computing, IEEE Open Journal of Circuits and Systems, IEEE Transactions on Network Science and Engineering, IEEE Transactions on Intelligent Transportation Systems, and IEEE Robotics and Automation Letters.

REFERENCES

1. Kang G. Shin
   Kevin and Nancy O'Connor Professor of Computer Science
   University of Michigan
   Email: kgshin@umich.edu
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   Relationship: Postdoc Mentor

2. Weisong Shi
   Alumni Distinguished Professor and Chair, Department of Computer and Information Sciences
   University of Delaware
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   Relationship: PhD Advisor

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   Relationship: Collaborator

7. Marco Brocanelli
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   Relationship: Collaborator