Liangkai Liu

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EMPLOYMENT

University of Delaware **DE, USA**
Postdoctoral Researcher *Mar. 2023 - present*

EDUCATION

Wayne State University **Detroit, USA**
Ph.D of Computer Science, GPA: 3.98/4.0 *Jan. 2018 - May. 2023*

Xidian University **Xi'an, China**
Bachelor of Telecommunication Engineering, GPA: 3.25/4.0 *Aug. 2013 - Jun. 2017*

RESEARCH INTERESTS

Topic: Edge Computing, Distributed Systems, Connected and Autonomous Vehicles
Advisor: Professor Weisong Shi.

TECHNICAL SKILLS

- **Systems:** ROS, ROS2, Autoware, Linux Ubuntu, Docker
- **Libraries and Protocols:** PyTorch, TensorFlow, CUDA, OpenCV, FFmpeg, RTSP
- **Programming Languages:** Python, C/C++, SQL, PHP

AWARDS AND ACHIEVEMENTS

- Department Travel Award for Outstanding Conference Publications, 2023.
- **RTSS** Student Travel Grant, 2022.
- Department Travel Award for Outstanding Conference Publications, 2022.
- NSF ACM/IEEE Symposium on Edge Computing(**SEC**) Student Travel Grant, 2021/2019/2018.
- Top Ten Seniors Award, School of Telecommunication Engineering, Xidian University, 2016.
- First Prize, CETC-10 Literature Review Contest, 2016.

ACADEMIC PROJECTS

Edge Computing for Connected and Autonomous Vehicles *May 2018 - Present*

- Design HydraOne from stretch, which is an indoor research and education platform. (HotEdge'19)
- Lead to develop a level-4 autonomous driving vehicles (called Hydra) based on Autoware and DriveWorks.
- DNN time variations profiling and optimization for autonomous driving vehicles. (RTSS'22, RTAS'23)
- Energy-efficient autonomous mobile robots. (SEC'19, ICRA'23)

Fuel Rate Modeling for Energy Efficient Autonomous Trucking *Mar. 2020 - Mar. 2021*

- Collect a three-month Engine Management System (EMS) and Instant Fuel Meter (IMF) dataset.
- Fine-grained real-time fuel rate prediction model.

Edge Computing Enabled Applications for Public Safety *Jan 2018 - Dec 2018*

- Propose edge-based attack detection called SafeShareRide in ridesharing services; leverage smartphones as the edge computing platform and it consists of three stages: speech recognition, driving behavior detection, and video capture and analysis. (SEC'18, HotEdge'18)

EXPERIENCE

Argonne National Laboratory **USA**
Research Intern *May 2021 - Aug. 2021*

- SAGE: Cyberinfrastructure for AI at the Edge
  - Evaluate the performance of different DNN optimization techniques for ML at the edge
  - Work on anytimg DNNs for real-time DNN inference.

Argonne National Laboratory **USA**
Research Intern *May 2020 - Aug. 2020*

- SAGE: Cyberinfrastructure for AI at the Edge
  - Evaluate the performance of ML applications using TensorFlow on RT and generic Linux kernel
  - Evaluate the performance of data communications in ROS and ROS2 on NVIDIA Jetson AGX/NX/TX2.

NetEase Hangzhou Research Center **Hangzhou, China**
Research Intern *Jul. 2017 - Oct. 2017*

- NetEase's Distributed File System
  - Evaluate some distributed file systems including GFS and HDFS.
  - Design and implement the uniform-blob based DFS for cloud service in NetEase.

REFERRED PUBLICATION

Conference Papers

1. **Liangkai Liu**, Yanzhi Wang, and Weisong Shi, Understanding Time Variations in DNN Inference for Autonomous Driving, in Proceedings of the Fourth Workshop on Benchmarking Machine Learning Workloads on Emerging Hardware (**MLBench**), June 8, 2023, Miami, FL USA..
2. **Liangkai Liu**, Ren Zhong, Aaron Willcock, Nathan Fisher, and Weisong Shi, An Open Approach to Energy-Efficient Autonomous Mobile Robots, in Proceedings of 2023 IEEE International Conference on Robotics and Automation (**ICRA**), May 29 - June 2, 2023, London, UK. (**top conference in robotics listed in csranking**)
3. 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 29th IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), 2023. (**top conference in embeded and real-time systems listed in csranking**)
4. **Liangkai Liu**, Zheng Dong, Yanzhi Wang, and Weisong Shi, Prophet: Realizing a Predictable Real-time Perception Pipeline for Autonomous Vehicles, in Proceedings of the 43rd IEEE Real-Time Systems Symposium (**RTSS**), 2022. (**top conference in embedded and real-time systems listed in csranking**)
5. **Liangkai Liu**, Baofu Wu, and Weisong Shi, A Comparison of Communication Mechanisms in Vehicular Edge Computing, in Proceedings of the 3rd USENIX Workshop on Hot Topics in Edge Computing (**HotEdge**), July 14, 2020, Boston, MA, USA.
6. **Liangkai Liu**, Jiamin Chen, Marco Brocanelli, and Weisong Shi, E2M: An Energy-Efficient Middleware for Computer Vision Applications on Autonomous Mobile Robots, in Proceedings of the fourth ACM/IEEE Symposium on Edge Computing (**SEC**), November 7-9, 2019, Arlington, VA, USA.
7. **Liangkai Liu**, Xingzhou Zhang, Mu Qiao, and Weisong Shi, SafeShareRide: Edge-based Attack Detection in Ridesharing Services, in Proceedings of the third ACM/IEEE Symposium on Edge Computing (**SEC**), Oct. 25-27, 2018. Bellevue, WA.
8. **Liangkai Liu**, Xingzhou Zhang, Mu Qiao, and Weisong Shi, SafeShareRide: Edge-based Attack Detection in Ridesharing Services, in Proceedings of the 1st USENIX Workshop on Hot Topics in Edge Computing (**HotEdge**), July 10, 2018. Boston, MA.
9. Yifan Wang, **Liangkai Liu**, Xingzhou Zhang, and Weisong Shi, HydraOne: An Indoor Experimental Research and Education Platform for CAVs, in Proceedings of the 2nd USENIX Workshop on Hot Topics in Edge Computing (**HotEdge**), July 9, 2019, Renton, USA.
10. Xingzhou Zhang, Yifan Wang, Sidi Lu, **Liangkai Liu**, Lanyu Xu, and Weisong Shi, OpenEI: An Open

Framework for Edge Intelligence, in Proceedings of the 39th IEEE International Conference on Distributed Computing Systems (**ICDCS**), Vision/Blue Sky Track, July 7-10, 2019, Dallas, USA.

11. 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 38th IEEE International Conference on Distributed Computing Systems (**ICDCS**), Vision/Blue Sky Track, July 2-5, 2018, Vienna, Austria.

Journal Papers

1. **Liangkai Liu**, Wei Li, Dawei Wang, Yi Wu, Ruigang Yang, and Weisong Shi, Fuel Rate Prediction for Autonomous Heavy-Duty Trucks, accepted to **IEEE Transactions on Intelligent Transportation Systems**. (**Impact Factor: 9.551**)
2. **Liangkai Liu** and Weisong Shi, $4C$: A Computation, Communication, and Control Co-Design Framework for CAVs, **IEEE Wireless Communications**, Vol. 28, No. 4, pp. 42-48, August 2021. (**Impact Factor: 12.777**)
3. **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, **IEEE Internet of Things Journal**, Vol. 8, No. 8, pp. 6469-6486, December 2020. (**Impact Factor: 10.238**)
4. 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. (**Impact Factor: 14.91**)
5. 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**, Vol. 6, No. 4, pp. 7301-7308, July 2021. (**Impact Factor: 4.3**)

Books

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

Verified and Recognized Reviewer

- IEEE/RSJ IROS 2023
- IEEE/RSJ IROS 2022
- IEEE ICRA 2023
- IEEE Communications Magazine
- Proceedings of the IEEE
- IEEE Transactions for 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

PROFESSIONAL SERVICES

- Technical Steering Committee Member of the Autoware Foundation.
- Webmaster, ACM/IEEE Symposium on Edge Computing (SEC'20, SEC'21, SEC'22)
- Webmaster, International Conference on Connected and Autonomous Driving (MetroCAD'20, MetroCAD'21, MetroCAD'22)