

## Highlights of Dr. Weisong Shi's Contributions

2023

Dr. Weisong Shi, an IEEE Fellow, has significantly contributed to multiple domains in computer and networked systems and its applications, including edge computing, connected and autonomous vehicles, and connected health. He is the Professor and Chair of the Department of Computer and Information Sciences at the University of Delaware (UD), leading the Connected and Autonomous Research Laboratory (CAR). Before joining UD, he was a faculty of Computer Science at Wayne State University. Dr. Shi has published 290 peer-reviewed conference papers and journal articles. He has been cited more than 20,000 times, with an H-index of 57. His contributions have earned him numerous prestigious academic honors and awards, including the NSF CISE Advisory Committee (2023-2026), Crain's Notable Leaders in EV (2022), AI 2000 Most Influential Scholar Award (2022), IEEE TCI Distinguished Service Award (2020), Most Downloaded Paper Award by IEEE Computer (2018), among others.

**Edge Computing:** Dr. Shi is recognized as a global leader in edge computing. His seminal paper, "Edge Computing: Vision and Challenges," has garnered over 6000 citations since 2016, indicating his pivotal role in shaping this field. He co-chaired the NSF Workshop on Grand Challenges in Edge Computing and was the founding steering committee chair of the ACM/IEEE Symposium on Edge Computing (SEC). Dr. Shi co-chaired NSF Workshop on Grand Challenges in Edge Computing in 2016, and led the development of the IEEE Course on Edge Computing. Besides, He also served as the lead guest editor for an edge computing special issue in the prestigious Proceedings of the IEEE journal. His work on Firework is the first one for collaborative data sharing and processing in edge computing. Firework allows developers to break down an application into subservices, thus distributing them in clouds and edges. In this case, Firework could speed up the development of edge-cloud environments with less response latency and network bandwidth cost and protect privacy. This work has attracted much attention in academia and industry and has been cited more than 160 times.

**Connected and Autonomous Vehicles:** Dr. Shi's technical contributions are well demonstrated through his pioneering work in developing platforms and solutions that address the complex challenges in the connected and autonomous driving sector. Under his guidance, the CAR lab has established a solid reputation for constructing secure, real-time, and energy-efficient computing systems for autonomous driving, including OpenVDAP, a pioneering Open Vehicular Data Analytics Platform for CAVs. Moreover, his contribution to "4C: A Computation Communication and Control Co-Design Framework for CAVs" exemplifies his commitment to improving safety and fuel efficiency in connected and autonomous vehicles. His work on E2M, an Energy-Efficient Middleware for Computer Vision Applications on Autonomous Mobile Robots, and Prophet, a Predictable Real-time Perception Pipeline for Autonomous Vehicles, have spurred significant advances in optimizing energy efficiency and DNN inference time variations.

Among the many innovative projects from his CAR Lab, I want to highlight two hardware platforms, HydraOne and Equinox. HydraOne is an open-source experimental platform that has become instrumental in autonomous driving research and education. Several institutions in the US adopted this platform to support their research. Equinox is an innovative platform for the next generation of roadside units (RSU) that allows for the study of co-optimization of computing and communication on CAVs, a vital facet of efficient smart transportation.

Dr. Shi envisions making connected and autonomous vehicles more accessible, particularly for people with disabilities. He now serves as the Center Director of eCAT, an NSF Industry-University Cooperative Research Center (IUCRC) to build a world-class industry-university research center for sustainable mobility technologies, and he is the chair of the IEEE STC on Autonomous Driving Technologies. Dr. Shi's visionary work on OpenVDAP, an open Vehicular Data Analytics Platform (OpenVDAP), serves as the core data sharing and accessing middleware for autonomous vehicles. In OpenVDAP, each application offers multiple execution pipelines in response to various network and computational constraints and an elastic management model to automatically choose an optimal pipeline by hardware-software co-optimizing. In addition, a library/API is provided for developers, enabling all data access with a secure method, which deals with developing a third-party application in connected and autonomous vehicles. The work has been cited 78 times and followed up by companies/organizations like Intel, ARM, Nvidia, Denso, and the Autoware Foundation.

**Smart Health and Energy Efficiency:** Additionally, Dr. Shi has significantly contributed to smart and connected health, leading the Wireless Health Initiative at Wayne State University and serving as the inaugural Editor-In-Chief of the Smart Health Journal. His work in this field intersects with his expertise in edge computing, creating possibilities for advancements in healthcare. In addition, Dr. Shi's expertise also extends to energy-efficient computing systems. His work includes studying battery management for mobile systems and energy-efficient data center design. His work, especially on Taobao Hadoop workload analysis, has won awards and has been adopted by industry giants like Baidu, Alibaba, and Intel.

**Community Leadership:** Dr. Shi's leadership contributions are as profound as his technical contributions. As Chair of the IEEE STC on Autonomous Driving Technologies, he has profoundly influenced the trajectory of this rapidly evolving field. His leadership role at the NSF IUCRC on electric, connected, and autonomous technology for mobility (eCAT) and his Autoware Strategy Planning Committee service displays his dedication and commitment to propelling these technologies forward. His entrepreneurial endeavors are manifest in his co-founding of the IEEE International Conference on Mobility: Operations, Services, and Technologies (MOST), which builds upon the successful Connected and Autonomous Driving workshop (MetroCAD). Since 2022, he has also served as the Autoware Center of Excellence Director at the University of Delaware, further amplifying his global impact on autonomous mobility.

**Education:** Beyond his research activities, Dr. Shi is deeply committed to advancing robotics and autonomous systems education. Dr. Shi introduced a Vertically Integrated Projects (VIP) course on autonomous vehicles, encouraging students from diverse backgrounds to engage with cutting-edge technologies and methodologies within vehicle computing. Furthermore, Dr. Shi has proposed the CAR Lab Summer Visiting Program (CSV), which provides mentorship and support for high school and undergraduate students interested in researching this rapidly growing field. These commitments were also showcased when Dr. Shi's group conducted a workshop on autonomous driving technology at HenHacks 2022. In terms of graduate student success, Dr. Shi has advised three female Ph.D. students to completion in the past three years. These alumni have proceeded to distinguished positions, with Lanyu Xu accepting a role as an assistant professor at Oakland University. Sidi Lu will join William and Mary as an assistant professor in August 2023

**Conclusion:** To conclude, Dr. Weisong Shi's pioneering research and invaluable contributions, particularly in edge computing and connected and autonomous vehicles, have profoundly impacted the scientific community and society. His revolutionary vision of vehicle computing stands as a guiding light, steering academia and industry towards unprecedented frontiers in research and technological advancements. In addition to his research, Dr. Shi's enduring influence on education and his exceptional community leadership propel the advancement of current scientific technologies and nurture an environment where technology emerges as a potent instrument for societal progress. His unique blend of visionary leadership, pioneering technical contributions, and unwavering dedication to nurturing future leaders in autonomous technologies make him an exemplary candidate.