Intelligent vehicles and Smart transportation

Downloaded from: https://research.chalmers.se, 2024-11-05 20:26 UTC

Citation for the original published paper (version of record):
Huang, J., Labi, S., Kulcsár, B. et al (2024). Intelligent vehicles and Smart transportation. Fundamental Research, 4(5): 979-980. http://dx.doi.org/10.1016/j.fmre.2024.08.004

N.B. When citing this work, cite the original published paper.

research.chalmers.se offers the possibility of retrieving research publications produced at Chalmers University of Technology. It covers all kind of research output: articles, dissertations, conference papers, reports etc. since 2004. research.chalmers.se is administrated and maintained by Chalmers Library

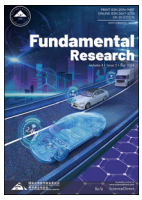
(article starts on next page)

Fundamental Research 4 (2024) 979–980

Contents lists available at ScienceDirect

Fundamental Research

journal homepage: http://www.keaipublishing.com/en/journals/fundamental-research/



Editorial

Intelligent vehicles and Smart transportation

Jin Huang[a,*], Samuel Labi[b], Balázs Adam Kulcsár[c], Yue Gao[d], Cristina Olaverri Monreal[e], Fei Wu[f], Zhicheng He[g], Xiaobo Qu[a]

[a] School of Vehicle and Mobility, Tsinghua University, Beijing 10084, China
[b] College of Engineering, Purdue University, IN 47907, USA
[c] Electrical Engineering, Chalmers University of Technology, Gothenburg 41296, Sweden
[d] School of Software, Tsinghua University, Beijing 10084, China
[e] Johannes Kepler University Linz, Linz 4040, Austria
[f] College of Mechanical and Vehicle Engineering, Chongqing University, Chongqing 400044, China
[g] College of Mechanical and Vehicle Engineering, Hunan University, Changsha 410082, China

Intelligent vehicles and smart transportation provide unprecedented opportunities to mitigate traffic congestion, save energy, reduce collisions, and enhance throughput. Key research and practices in this field include advanced vehicle technologies, high-resolution data analytics, novel paradigms for mobility services, and systems of multiple systems, among others. These technologies encompass a broad range of innovations aimed at improving vehicle performance, safety, efficiency, and environmental impact, while also reshaping how people and goods move. Recent and prospective breakthroughs in these areas are inherently interdisciplinary and have the potential to fundamentally revolutionize the nature and scope of intelligent transportation systems (ITS) as both a scientific discipline and a thriving industry. The field holds great promise for transforming our urban environments and quality of life. Remarkable breakthroughs in smart transportation, driven by cutting-edge technologies and sophisticated algorithms, include advancements in electric-driven vehicles, intelligent and connected vehicles, advanced manufacturing techniques, digital twin techniques, vehicle-to-everything (V2X) communication, enhanced safety systems, sustainable and smart mobility solutions, data-driven mobility solutions, enhanced infotainment systems, smart infrastructure, mobility-as-a-service (MaaS), and urban aerial mobility (UAM). These innovations are reshaping our approach to urban mobility, traffic management, and the overall transportation ecosystem.

Despite these advances, the application of intelligent vehicles and smart transportation systems is still in an exploratory stage, facing several significant challenges. These challenges include sensor reliability and accuracy, integration of technologies (V2X, AI, high-definition mapping), computing power and data processing, cybersecurity and data privacy, economic and business model challenges, regulatory and legal issues, infrastructure development, and social acceptance and ethical concerns, *etc.* Addressing these challenges requires a multifaceted approach involving technological innovation, regulatory frameworks, public engagement, and sustainable practices. Future work in this field is suggested in the following areas: (1) Multi-vehicle intelligence, a current development trend, should not only focus on achieving comprehensive perception, driving decision-making, and control execution but also enhance intelligent road infrastructure, realize comprehensive intelligent cooperation, and improve commercial landing, thereby fostering the integrated development of vehicles and roads and advancing autonomous driving. (2) The application of AI algorithms in vehicle communication has become a new research hotspot. To improve the quality of datasets, reduce interference from emergencies, optimize control algorithms, and enhance ride comfort, further research is needed. (3) Research on high-level autonomous vehicle test evaluation indices, models, and systems is still in its infancy. Future efforts should focus on test scenario classification, test task classification, improving the testing system, and accelerating the establishment of unified evaluation standards to strengthen the comprehensive evaluation system that integrates subjective and objective research.

This special issue of Fundamental Research on Intelligent vehicles and smart transportation collects eight papers: one review article and seven original research articles that showcase the latest achievements and envision the future of this field. Autonomous vehicles (AV) are rapidly becoming integrated into everyday life, with several countries anticipating their inclusion in public transport networks in the coming years. The AV domain is one of the fastest-growing areas due to rapid advances in computing, electronics, sensors, and communication technologies. Guo et al.[1] developed a domain adaptive semantic segmentation based on optimal transport in autonomous driving. Zhu et al.[2] proposed a bi-level ramp merging strategy for dense mixed traffic conditions to improve efficiency, emissions, and safety. Maksym et al. [3] developed an inverse motion planning technique for autonomous vehicles using integral nonlinear constraints. From the perspective of transportation electrification, Qu et al.[4] introduced an alternative pathway based on vehicle-to-vehicle (V2V) charging to reduce production costs and improve energy efficiency. Since CO_2 emissions from new energy vehicles (NEV) are non-negligible, Zhang et al. [5] proposed a framework for high-resolution well-to-wheel (WTW) CO_2 emission estimation for a full sample of vehicles, revealing the unique CO_2 emission characteristics of different vehicle categories. With their high efficiency, zero

* Corresponding author.
E-mail address: huangjin@tsinghua.edu.cn (J. Huang).

https://doi.org/10.1016/j.fmre.2024.08.004
2667-3258/© 2019 The Authors. Publishing Services by Elsevier B.V. on behalf of KeAi Communications Co. Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)

pollution, and quiet operation, fuel cell vehicles (FCVs) have been promoted by many countries for green transportation. Yang et al.[6] optimized the hydrophobicity gradient of fuel cell gas diffusion media for vehicular applications. Urban Air Mobility (UAM) is an emerging transportation system that aims to revolutionize urban mobility. Liu et al.[7] reviewed the UAM system and the application of IT in UAM, discussing the major challenges and future potential of this transportation system. Zhang et al.[8] proposed a novel approach to improve the dynamic performance of software-defined vehicles (SDV) based on active structural transformation, which avoids rollover in critical situations and provides a more comfortable ride experience.

We hope this special issue will promote active scientific communication and spark further advancements in intelligent vehicles and smart transportation. Finally, as guest editors of this special issue, we extend our gratitude to all the authors for their outstanding contributions, to the editorial board members for their invaluable support and assistance, and to the referees for their thoughtful and helpful advice on these papers.

References

[1] Y Guo, X Wang, C Li, et al., Domain adaptive semantic segmentation by optimal transport, Fund. Res. 4 (5) (2023) 981–991.
[2] J Zhu, K Gao, H Li, et al., Bi-level ramp merging coordination for dense mixed traffic conditions, Fund. Res. 4 (5) (2023) 992–1008.
[3] M Diachuk, SM. Easa, Developing inverse motion planning technique for autonomous vehicles using integral nonlinear constraints, Fund. Res. 4 (5) (2023) 1049–1064.
[4] X Qu, H Shao, S Wang, et al., Are more charging piles imperative to future electrified transportation system? Fund. Res. 4 (5) (2022) 1009–1016.
[5] Z Zhang, H Su, W Yao, et al., Uncovering the CO2 emissions of vehicles: A well–to-wheel approach, Fund. Res. 4 (5) (2023) 1026–1037.
[6] Q Yang, Z Zhang, G Xiao, et al., Hydrophobicity gradient optimization of fuel cell gas diffusion media for its application in vehicles, Fund. Res. 4 (5) (2024) 1038–1048.
[7] Y Liu, C Lyu, F Bai, et al., The role of intelligent technology in the development of urban air mobility systems: A technical perspective, Fund. Res. 4 (5) (2023) 1017–1025.
[8] B Zhang, J Huang, J Wang, et al., Can software-defined vehicles never roll over: A perspective of active structural transformation, Fund. Res. 4 (5) (2024) 1065–1073.

Jin Huang is an associate professor at the School of Vehicle and Mobility, Tsinghua University, and a recipient of the National Science Fund for Excellent Young Scholars. He currently serves as the Deputy Director of the Institute of Automotive Engineering at the School of Vehicle and Mobility, Tsinghua University, and Assistant Director of the National Key Laboratory of Green Intelligent Vehicles and Transportation. His primary research areas include intelligent vehicle design and autonomous driving. He has published over 60 SCI papers, and has been granted more than 40 invention patents and over 10 software copyrights.

Yue Gao is a tenured associate professor with the School of Software, Tsinghua University. He has been with the School of Computing, National University of Singapore, and also with the Medicine School, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA. His research interests include artificial intelligence and hypergraph computation. Part of his research achievements has won the CIE first prize in natural science award. Dr. Gao currently serves as an editorial board member of the *International Journal of Computer Vision* (*IJCV*) and *Medical Image Analysis* (*MedIA*) and has frequently chaired sessions at conferences such as MICCAI, ICME, ICIP, and ICASSP.

Xiaobo Qu is a professor with the School of Vehicle and Mobility, Tsinghua University, and an elected member of Academia Europaea. His research is focused on intelligent transportation systems, vertical transportation systems, and vehicle-city connectivity. Dr Qu currently serves as the Editor in Chief of *Communications in Transportation Research*, the executive Editor in Chief of *Journal of Intelligent and Connected Vehicles*, and an editor of *Transportation Research Part A/Part E, The Innovation, IEEE Transactions on Cybernetics, and ASCE Journal of Transportation Engineering*. Prior to his current appointment with Tsinghua University, he was a faculty member in Australia from 2012 to 2017, a professor with Chalmers University of Technology from 2018 to 2019, and a chair professor with Chalmers University of Technology from 2020 to 2021.