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PREFACE

Preface for Feature Topic on Human Driver Behaviours for Intelligent Vehicles

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1 Introduction

With the advancement of sensing, machine learning, and computing systems, automated driving applications have been growing rapidly worldwide. Together with the development of communication technologies such as dedicated short-range communication, extensively emerging intelligent vehicles have been developed to connect with vehicles, pedestrians, infrastructures, and clouds in the transportation network. Thus, intelligent vehicles have become intelligent mobile terminal that carries rich functions and services, which expand and deepen the scope of human–machine interaction between human drivers and intelligent vehicles in the intelligent cockpit. Human drivers are the center of intelligent vehicles. To make future vehicles trustworthy in driving safety, acceptable in social travel efficiency, and comfortable in the driving experience, developing technologies based on human drivers' reliable knowledge and cognitive intelligence together with smart operation is an essential and promising solution. However, there are many challenges to be addressed including real-time human driver perception, adaptive regulation of inappropriate driving operation, safe and comfortable interaction between human drivers and intelligent vehicles intelligent cockpits, etc.

To alleviate these challenges, emerging technologies based on artificial intelligence are gradually becoming overwhelming in the related communities. This special issue aims to provide a platform for researchers, engineers, and policymakers to publish their latest research findings or engineering experiences in developing and applying novel technologies to address the challenges concerning human driver behaviours for intelligent vehicles.

Four articles are collected in this feature topic that promotes the recent advances in the field of human driver behaviours for intelligent vehicles. The core contributions of these four articles are summarized below.

2 Highlight of Articles in the Feature Topic

1. The paper titled "Review and Perspectives on Human Emotion for Connected Automated Vehicles" by Wenbo Li et al. provides a comprehensive literature survey of emotion studies covering multiple perspectives, aiming to enhance the design of affective interaction in intelligent cockpit within connected automated vehicles (CAVs). It discusses the multimodal expression of human emotions, investigates the human emotion experiment in driving, and particularly emphasizes the previous knowledge on human emotion detection, regulation, as well as their applications in CAVs. The promising research perspectives are outlined for researchers and engineers from different research areas to develop CAVs with better acceptance, safety, comfort, and enjoyment levels.
2. The paper titled "Driver Steering Behaviour Modelling Based on Neuromuscular Dynamics and Multi-Task Time-Series Transformer" by Yang Xing et al. develops a multi-task sequential learning framework to predict future steering torques and steering postures based on upper limb neuromuscular Electromyography (EMG) signals. The findings hold significant promise for the advancement of driver steering assistance systems, fostering mutual comprehension and synergy between human drivers and intelligent vehicles.

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3. The paper titled “Curve Trajectory Model for Human Preferred Path Planning of Automated Vehicles” by Gergo Ferenc Igneczi et al. proposes a linear driver model, which can calculate node points reflective of human driver preferences and based on these node points a human driver preferred motion path can be designed for autonomous driving. The results hold promising implications for the seamless integration of autonomous driving systems with human driving preferences.
4. The paper titled “A Hierarchical LSTM-Based Vehicle Trajectory Prediction Method Considering Interaction Information” by Haitao Min et al. introduces a hierarchical LSTM-based method for vehicle trajectory prediction, which integrates driving intention prediction and lane change time prediction, establishing an innovative "intention-time-trajectory" hierarchical model framework. The results show that the proposed hierarchical LSTM method has a lower prediction error compared to the integral LSTM model.

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Dongpu Cao received the Ph.D. degree from Concordia University, Canada, in 2008. He is a Professor at Tsinghua University. His current research focuses on driver cognition, automated driving and cognitive autonomous driving. He has contributed more than 200 papers and 3 books. He received the SAE Arch T. Colwell Merit Award in 2012, IEEE VTS 2020 Best Vehicular Electronics Paper Award and 6 Best Paper Awards from international conferences. Prof. Cao has served as Deputy Editor-in-Chief for IET Intelligent Transport Systems Journal, and an Associate Editor for IEEE Transactions on Vehicular Technology, IEEE Transactions on Intelligent Transportation Systems, IEEE/ASME Transactions on Mechatronics, IEEE Transactions on Industrial Electronics, IEEE/CAA Journal of Automatica Sinica, IEEE Transactions on Computational Social Systems, and ASME Journal of Dynamic Systems, Measurement and Control. Prof. Cao is an IEEE VTS Distinguished Lecturer.

Argyrios Zolotas received his Ph.D. degree in advanced electronic and electrical engineering from Loughborough University, Loughborough, U.K., in 2002. He held academic positions with the University of Sussex, Brighton, U.K. and Loughborough University, and a Postdoctoral Research Fellowship with Imperial College London, U.K. In 2014, he joined the School of Engineering, University of Lincoln, U.K., as a Reader and the Deputy Director of research. Since 2019, he has been a Reader in systems and control with the Centre of Autonomous and Cyber-Physical Systems, School of Aerospace, Cranfield University, Cranfield, U.K. His expertise is in Systems and Control Engineering, including robust control and fault tolerant control, system architecture, and AI-based and data-driven control. Since joining Cranfield University, he is leading work in autonomous systems for ground, aerial and rail-related concepts.

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