The State of IEEE Transactions on Intelligent Vehicles: From Passive Publication to Active and Smart Exchange and Dissemination

Dear All,

I have good news to share with you: Thanks to the great effort and enthusiastic dedication by our Reviewers, Associate Editors, and Senior Editors, by the end of March, we have completed the review processes for 144 of 145 manuscripts submitted during past three years from 2019-2021 (the manuscript still under review was my submission last year, which is out of my administration), and more, we have received 365 new submissions between January to March this year, 1.52 times more than the total number of submissions received in the entire year of 2021, furthermore, we have completed the review processes for 297 of those 365 newly received manuscripts.

Due to the concerns for review workload and quality, I had expected a large number of complaints for my ambitious and tough "3224" demand [1]. However, both the response to and result of the new policy are far beyond my expectation. We do have received 7 complaints on our 441 review reports, all on the review of old submissions, 5 complaints are misunderstanding, 1 complaint is justified and solved with the satisfaction to authors, reviewers, and associate editors, the last one by one of our Associate Editors was not filed to me, but to the ITSS president, and is still in the process of investigation.

Currently, the number of submissions per day (spd) for TIV is 4.17, we are expecting to receive over 1200 submissions this year. At this point, our rate of acceptance is 19.4%, and our average processing time is 21 days for those completed reviews. This is a significant improvement for TIV and we will do our best to maintain this momentum.

Although TIV is one of the youngest journals in the IEEE publication family, it is now in a phase of rapid development. I would like to take this opportunity to transform IEEE TIV from a passive journal of publication to an active and smart platform for exchange and dissemination. For this purpose, we have started to look into methods and tools in decentralized autonomous organizations and operations, as well as distributed and decentralized hybrid media and workshops beyond traditional social networking.

Again, I want to thank you all for your help and support.

On February 22, 2022, I reported the state of the IEEE TIV as well as my plan to IEEE ITSS Publication Board. On February 23, 2022, I presented the same report to the IEEE TIV Steering Committee. Both ITSS Publication Board and TIV Steering Committee have supported our plan to make TIV a monthly publication next year. Let's hope the due processes required for this change can be completed timely by our four sponsoring societies, that is, IEEE ITSS, VTS, RAS, and CSS. We are looking forward to this new and historical development.

A more detailed report on the state of TIV can be found after the Scanning the Issue.

I. SCANNING THE ISSUE

Dynamic Object Removal and Spatio-Temporal RGB-D Inpainting via Geometry-Aware Adversarial Learning

Bešić Borna and Valada Abhinav

Dynamic objects have a significant impact on the robot's perception of the environment which degrades the performance of essential tasks such as localization and mapping. In this work, we address this problem by synthesizing plausible color, texture and geometry in regions occluded by dynamic objects. We propose the novel geometry-aware DynaFill architecture that follows a coarse-to-fine topology and incorporates our gated reccurrent feedback mechanism to adaptively fuse information from previous timesteps. We optimize our architecture using adversarial training to synthesize fine realistic textures which enables it to hallucinate color and depth structure in occluded regions online in a spatially and temporally coherent manner, without relying on future frame information. Casting our inpainting problem as an image-to-image translation task, our model also corrects regions correlated with the presence of dynamic objects in the scene, such as shadows or reflections. We introduce a large-scale hyperrealistic dataset with RGB-D images, semantic segmentation labels, camera poses as well as groundtruth RGB-D information of occluded regions. Extensive quantitative and qualitative evaluations show that our approach achieves stateof-the-art performance, even in challenging weather conditions. Furthermore, we present results for retrieval-based visual localization with the synthesized images that demonstrate the utility of our approach.

Optimal Coordination of Platoons of Connected and Automated Vehicles at Signal-Free Intersections

Kumaravel Sharmila Devi, Malikopoulos Andreas and Ayyagari Ramakalyan

In this paper, we address the problem of coordinating platoons of connected and automated vehicles crossing a signal-free intersection. We present a decentralized, two-level optimal framework to coordinate the platoons with the objective to minimize travel delay and fuel consumption of every platoon

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crossing the intersection. At the upper-level, each platoon leader derives a proven optimal schedule to enter the intersection. At the low-level, the platoon leader derives their optimal control input (acceleration/deceleration) for the optimal schedule derived in the upper-level. We validate the effectiveness of the proposed framework in simulation and show significant improvements both in travel delay and fuel consumption compared to the baseline scenarios where platoons enter the intersection based on first-come-first-serve and longest queue first - maximum weight matching scheduling algorithms.

Digital Twin-Assisted Cooperative Driving at Non-Signalized Intersections

Wang Ziran, Han Kyungtae and Tiwari Prashant

Digital Twin, as an emerging technology related to Cyber-Physical Systems (CPS) and Internet of Things (IoT), has attracted increasing attentions during the past decade. Conceptually, a Digital Twin is a digital replica of a physical entity in the real world, and this technology is leveraged in this study to design a cooperative driving system at non-signalized intersections, allowing connected vehicles to cooperate with each other to cross intersections without any full stops. Within the proposed Digital Twin framework, we developed an enhanced first-in-firstout (FIFO) slot reservation algorithm to schedule the sequence of crossing vehicles, a consensus motion control algorithm to calculate vehicles' referenced longitudinal motion, and a modelbased motion estimation algorithm to tackle communication delay and packet loss. Additionally, an augmented reality (AR) humanmachine-interface (HMI) is designed to provide the guidance to drivers to cooperate with other connected vehicles. Agent-based modeling and simulation of the proposed system is conducted in Unity game engine based on a real-world map in San Francisco, and the human-in-the-loop (HITL) simulation results prove the benefits of the proposed algorithms with 20% reduction in travel time and 23.7% reduction in energy consumption, respectively, when compared with traditional signalized intersections.

Vision-Cloud Data Fusion for ADAS: A Lane Change Prediction Case Study

Liu Yongkang, Wang Ziran, Han Kyungtae, Shou Zhenyu, Tiwari Prashant and Hansen John

With the rapid development of intelligent vehicles and Advanced Driver-Assistance Systems (ADAS), a new trend is that mixed levels of human driver engagements will be involved in the transportation system. Therefore, necessary visual guidance for drivers is vitally important under this situation to prevent potential risks. To advance the development of visual guidance systems, we introduce a novel vision-cloud data fusion methodology, integrating camera image and Digital Twin information from the cloud to help intelligent vehicles make better decisions. Target vehicle bounding box is drawn and matched with the help of the object detector (running on the ego-vehicle) and position information (received from the cloud). The best matching result, a 79.2% accuracy under 0.7 intersection over union threshold, is obtained with depth images served as an additional feature source. A case study on lane change prediction is conducted to show the effectiveness of the proposed data fusion methodology. In the case study, a multi-layer perceptron algorithm is proposed with modified lane change prediction approaches. Human-in-the-loop simulation results obtained from the Unity game engine reveal that the proposed model can improve highway driving performance significantly in terms of safety, comfort, and environmental sustainability.

Predicting Pedestrian Crossing Intention with Feature Fusion and Spatio-Temporal Attention

Yang Dongfang, Zhang Haoliin, Yurtsever Ekim, Redmill Keith and Ozguner Umit

Predicting vulnerable road user behavior is an essential prerequisite for deploying Automated Driving Systems (ADS) in the real-world. Pedestrian crossing intention should be recognized in real-time, especially for urban driving. Recent works have shown the potential of using vision-based deep neural network models for this task. However, these models are not robust and certain issues still need to be resolved. First, the global spatio-temporal context that accounts for the interaction between the target pedestrian and the scene has not been properly utilized. Second, the optimal strategy for fusing different sensor data has not been thoroughly investigated. This work addresses the above limitations by introducing a novel neural network architecture to fuse inherently different spatio-temporal features for pedestrian crossing intention prediction. We fuse different phenomena such as sequences of RGB imagery, semantic segmentation masks, and ego-vehicle speed in an optimal way using attention mechanisms and a stack of recurrent neural networks. The optimal architecture was obtained through exhaustive ablation and comparison studies. Extensive comparative experiments on the JAAD and PIE pedestrian action prediction benchmarks demonstrate the effectiveness of the proposed method, where state-of-the-art performance was achieved. Our code is open-source and publicly available: https://github.com/OSU-Haolin/Pedestrian Crossing Intention Prediction.

Bio-inspired Neural Network-based Optimal Path Planning for UUVs under the Effect of Ocean Currents

Zhu Danjie and Yang Simon X

To eliminate the effect of ocean currents when addressing the optimal path in the underwater environment, an intelligent algorithm designed for the unmanned underwater vehicle (UUV) is proposed in this paper. The algorithm consists of two parts: a neural network-based algorithm that deducts the shortest path and avoids all possible collisions; and an adjusting component that balances off the deviation brought by the effect of ocean currents. The optimization results of the proposed algorithm are presented in details, and compared with the path planning algorithm that does not consider the effect of currents. Results

of the comparison prove the effectiveness of the path planning method when encountering currents of different directions and velocities.

Monocular 3D Object Detection with Sequential Feature Association and Depth Hint Augmentation

Gao Tianze, Pan Huihui and Gao Huijun

Monocular 3D object detection, with the aim of predicting the geometric properties of on-road objects, is a promising research topic for the intelligent perception systems of autonomous driving. Most state-of-the-art methods follow a keypoint-based paradigm, where the keypoints of objects are predicted and employed as the basis for regressing the other geometric properties. In this work, a unified network named as FADNet is presented to address the task of monocular 3D object detection. In contrast to previous keypoint-based methods, we propose to divide the output modalities into different groups according to the estimation difficulty of object properties. Different groups are treated differently and sequentially associated by a convolutional Gated Recurrent Unit. Another contribution of this work is the strategy of depth hint augmentation. To provide characterized depth patterns as hints for depth estimation, a dedicated depth hint module is designed to generate row-wise features named as depth hints, which are explicitly supervised in a bin-wise manner. The contributions of this work are validated by conducting experiments and ablation study on the KITTI benchmark. Without utilizing depth priors, post optimization, or other refinement modules, our network performs competitively against state-of-the-art methods while maintaining a decent running speed.

A Taxonomy to Unify Fault Tolerance Regimes for Automotive Systems: Defining Fail-Operational, Fail-Degraded, and Fail-Safe

Stolte Torben, Ackermann Stefan, Graubohm Robert, Jatzkowski Inga, Klamann Björn, Winner Hermann and Maurer Markus

This paper presents a taxonomy that allows defining the fault tolerance regimes fail-operational, fail-degraded, and fail-safe in the context of automotive systems. Fault tolerance regimes such as these are widely used in recent publications related to automated driving, yet without definitions. This largely holds true for automotive safety standards, too. We show that fault tolerance regimes defined in scientific publications related to the automotive domain are partially ambiguous as well as taxonomically unrelated. The presented taxonomy is based on terminology stemming from ISO 26262 as well as from systems engineering. It uses four criteria to distinguish fault tolerance regimes. In addition to fail-operational, fail-degraded, and failsafe, the core terminology consists of operational and fail-unsafe. These terms are supported by definitions of available performance, nominal performance, functionality, and a concise definition of the safe state. For verification, we show by means of two examples from the automotive domain that the taxonomy can be applied to hierarchical systems of different complexity.

An Optimization-based Approach for Resilient Connected and Autonomous Intersection Crossing Traffic Control under V2X Communication

Lu Qiang, Jung Hojin and Kim Kyoung-Dae

In this paper, we present an optimization-based approach for safe, efficient, and resilient autonomous intersection traffic control in realistic vehicle-to-everything (V2X) communication environment. The proposed framework produces the fastest discrete-time trajectory for vehicles who want to cross an intersection. Constraints for safety are designed carefully in the optimization problem formulation to prevent potential collisions during intersection crossings. A novel vehicle-to-intersection (V2I) interaction mechanism is designed to handle imperfect communication characteristics such as packet delivery delay and loss. The proposed intersection management framework is evaluated by running extensive simulations using an open source vehicular network and microscopic traffic simulation software, Veins. The results show that the overall traffic control performance of the proposed framework is substantially better than conventional traffic light control framework even in situations with a realistic wireless vehicular network setting where packet delivery delays and drops occasionally occur.

Tunable Trajectory Planner Using G3 Curves

Botros Alexander and Smith Stephen L.

Trajectory planning is commonly used as part of a local planner in autonomous driving. This paper considers the problem of planning a continuous-curvature-rate trajectory between fixed start and goal states that minimizes a tunable trade-off between passenger comfort and travel time. The problem is an instance of infinite dimensional optimization over two continuous functions: a path, and a velocity profile. We propose a simplification of this problem that facilitates the discretization of both functions. This paper also proposes a method to quickly generate minimal-length paths between start and goal states based on a single tuning parameter: the second derivative of curvature. Further, we discretize the set of velocity profiles along a given path into a selection of longitudinal jerk way-points along the path. Finally, we repeatedly solve the path and velocity profiles in an iterative fashion. Numerical examples are provided to illustrate the benefits of the proposed methods.

Parallel Vision for Long-Tail Regularization: Initial Results from IVFC Autonomous Driving Testing

Wang Jiangong, Wang Xiao, Shen, Tianyu, Wang Yutong, Li Li, Tian Yonglin, Yu Hui, Chen Long, Xin Jingmin, Wu Xiangbin, Zheng Nanning and Wang Fei-Yue

Long-tail effect, characterized by highly frequent occurrence of normal scenarios and the scarce appearance of extreme "long-tail" scenarios, ubiquitously exists in the visionrelated problems in the real-world applications. Though many computer vision methods to date have already achieved feasible performance for most of the normal scenarios, it is still challenging for existing vision systems to accurately perceive the long-tail scenarios. This deficiency largely hinders the

practical application of computer vision systems, since long-tail problems may incur fatal consequences, such as traffic accidents, taking the vision systems of autonomous vehicles as an example. In this paper, we firstly propose a theoretical framework named Long-tail Regularization (LoTR), for analyzing and tackling the long-tail problems in the vision perception of autonomous driving. LoTR is able to regularize the scarcely occurred longtail scenarios to be frequently encountered. Then we present a Parallel Vision Actualization System (PVAS), which consists of closed-loop optimization and virtual-real interaction, to search for challenging long-tail scenarios and produce large-scale longtail driving scenarios for autonomous vehicles. In addition, we introduce how to perform PVAS in Intelligent Vehicle Future Challenge of China (IVFC), the most durable autonomous driving competition around the world. Results over the past decade demonstrate that PVAS can effectively guide the collection of long-tail data to diminish the cost in the real world, and thus promote the capability of vision systems to adapt to complex environments, alleviating the impact of long-tail effect.

Towards an Ontology for Scenario Definition for the Assessment of Automated Vehicles: An Object-Oriented Framework

De Gelder Erwin, Paardekooper Jan-Pieter, Khabbaz Saberi Arash, Elrofai Hala, Camp Olaf op den, Kraines Steven, Ploeg Jeroen and De Schutter Bart

The development of new assessment methods for the performance of automated vehicles is essential to enable the deployment of automated driving technologies, due to the complex operational domain of automated vehicles. One contributing method is scenario-based assessment in which test cases are derived from real-world road traffic scenarios obtained from driving data. Given the complexity of the reality that is being modeled in these scenarios, it is a challenge to define a structure for capturing these scenarios. An intensional definition that provides a set of characteristics that are deemed to be both necessary and sufficient to qualify as a scenario assures that the scenarios constructed are both complete and intercomparable.

In this article, we develop a comprehensive and operable definition of the notion of scenario while considering existing definitions in the literature. This is achieved by proposing an object-oriented framework in which scenarios and their building blocks are defined as classes of objects having attributes, methods, and relationships with other objects. The object-oriented approach promotes clarity, modularity, reusability, and encapsulation of the objects. We provide definitions and justifications of each of the terms. Furthermore, the framework is used to translate the terms in a coding language that is publicly available.

Robust Adaptive Path-Tracking Control of Autonomous Ground Vehicles with Considerations of Steering System Backlash

Zhou Xingyu, Wang Zejiang, Shen Heran and Wang Junmin

Backlash phenomena have haunted control engineers for ages. Concerning the ground vehicle path-tracking control system design, the steering system's backlash attribute is often overlooked. If not properly compensated, the backlash nonlinearity tends to provoke unfavorable consequences including erroneous positioning of the road-wheel steering angle, response chattering, limit-cycle-like oscillations, and delays. This paper pioneers to employ an adaptive inverse controller to offset the dynamics of the steering system's backlash. Overall, the pathfollowing objective is accomplished via a novel trio-loop control architecture, which decomposes the tracking objectives into kinematic, vehicular lateral dynamics, and steering backlash compensation sub-levels. All adaptive control laws are robustified by means of sigma modification. Hardware-in-the-loop experimental results are presented to demonstrate the superiorities of the proposed solution.

A Progressive Review - Emerging Technologies for ADAS Driven Solutions

Jaswanth Nidamanur, Nibhanupudi Chinmayi, Assfalg Rolf and Venkataraman Hrishikesh

Over the last decade, the Advanced Driver Assistance System (ADAS) concept has evolved significantly. ADAS involves several technologies such as automotive electronics, vehicle-to-vehicle (V2V) vehicle-to-infrastructure (V2I) communication, RADAR, LIDAR, computer vision, and machine learning. Of these, computer vision and machine learning based solutions have mainly been effective that have allowed real-time vehicle control, driver aided systems, etc. However, most of the existing works deal with the deployment of ADAS and autonomous driving functionality in countries with well-disciplined lane traffic. Nevertheless, these solutions and frameworks do not work in countries and cities with less-disciplined/chaotic traffic. This paper identifies the research gaps, reviews the state-of-the-art looking at the different functionalities of ADAS and its levels of autonomy. Importantly, it provides a detailed description of vision intelligence and computational intelligence for ADAS. The eye-gaze and head pose estimation in vision intelligence is detailed. Notably, the learning algorithms such as supervised, unsupervised, reinforcement learning and deep learning solutions for ADAS are considered and discussed. Significantly, this would enable developing a real-time recommendation system for systemassisted/autonomous vehicular environments with less-disciplined road traffic.

Practical Distributed Control for VTOL UAVs to Pass a Virtual Tube

Quan Quan, Fu Rao, Li Mengxin, Wei Donghui, Gao Yan and Cai Kai-Yuan

Unmanned Aerial Vehicles (UAVs) are now becoming increasingly accessible to amateur and commercial users alike. An air traffic management (ATM) system is needed to help ensure that this newest entrant into the skies does not collide with others. In an ATM, airspace can be composed of airways, intersections and nodes. In this paper, for simplicity, distributed coordinating the motions of Vertical TakeOff and Landing (VTOL) UAVs to pass an airway is focused. This is formulated as a tube passing problem, which includes passing a virtual tube, interagent collision

avoidance and keeping within the virtual tube. Lyapunov-like functions are designed elaborately, and formal analysis based on invariant set theorem is made to show that all UAVs can pass the virtual tube without getting trapped, avoid collision and keep within the virtual tube. What is more, by the proposed distributed control, a VTOL UAV can keep away from another VTOL UAV or return back to the virtual tube as soon as possible, once it enters into the safety area of another or has a collision with the virtual tube during it is passing the virtual tube. Simulations and experiments are carried out to show the effectiveness of the proposed method and the comparison with other methods.

An Optimization-based Path Planning Approach for Autonomous Vehicles using dynEFWA-Artificial Potential Field

Li Hongcai, Liu Wenjie, Yang Chao, Wang Weida, Qie Tianqi and Xiang Changle

With the rapid development of autonomous driving technology, collision avoidance has become a research hotspot since it has the potential to increase safety. To obtain a collisionfree path, the artificial potential field (APF) is widely used as a path planning method. APF is capable of establishing functional relationships between the vehicle and surrounding objects. However, the function features of the traditional APF method can cause autonomous vehicles to fall into the local minimum, and the generated zigzag path may be difficult to follow. Motivated by these challenges, this paper proposes a real-time path planning method for autonomous vehicles using the dynamic enhanced firework algorithm-APF. Firstly, to improve the safety and smoothness of the planned path by the traditional APF method, the constraints of the vehicle dynamics and different types of obstacles are taken into consideration. Secondly, an optimization problem is formulated to find an optimal path with the least cost in the driving area. Finally, the proposed method is verified with both a simulation and a hardware-in-loop test environment. The results show that the studied autonomous vehicle successfully avoids obstacles and arrives at the goal position by using the proposed path-planning method, and the path smoothness is improved.

Robust Control of Connected Cruise Vehicle Platoon With Uncertain Human Driving Reaction Time

Xu Zhanrui and Jiao Xiaohong

Connected cruise control (CCC), as an advanced driver assistance system (ADAS), can enhance the stability and safety of the traffic flow. It is worth noting that the uncertain human driving reaction time will seriously affect the stability of the entire CCC system. In this paper, the car-following platoon is considered, where the CCC autonomous vehicle at the tail receives velocity and position signals of $n$human-driven vehicles ahead through wireless vehicle-to-vehicle (V2V) communication. To overcome the influence of uncertain human driving reaction time, a robust feedback controller is designed by only using the current states of each preceding vehicle and the ego vehicle based on LaSalle-Yoshizawa-like condition. The stability of the CCC vehicle in closed-loop system is analyzed by LyapunovRazumikhin approach and the string stability of the whole CCC system is ensured by dissipativity with L_2 gain. The practicability of the designed robust controller is verified by simulation comparison with other design scheme.

Gaze Preserving CycleGANs for Eyeglass Removal & Persistent Gaze Estimation

Rangesh Akshay, Zhang Bowen and Trivedi Mohan M.

A driver's gaze is critical for determining their attention, state, situational awareness, and readiness to take over control from partially automated vehicles. Estimating the gaze direction is the most obvious way to gauge a driver's state under ideal conditions when limited to using non-intrusive imaging sensors. Unfortunately, the vehicular environment introduces a variety of challenges that are usually unaccounted for - harsh illumination, nighttime conditions, and reflective eyeglasses. Relying on head pose alone under such conditions can prove to be unreliable and erroneous. In this study, we offer solutions to address these problems encountered in the real world. To solve issues with lighting, we demonstrate that using an infrared camera with suitable equalization and normalization suffices. To handle eyeglasses and their corresponding artifacts, we adopt image-to-image translation using generative adversarial networks to pre-process images prior to gaze estimation. Our proposed Gaze Preserving CycleGAN (GPCycleGAN) is trained to preserve the driver's gaze while removing potential eyeglasses from face images. GPCycleGAN is based on the well-known CycleGAN approach - with the addition of a gaze classifier and a gaze consistency loss for additional supervision. Our approach exhibits improved performance, interpretability, robustness and superior qualitative results on challenging real-world datasets.

Safe Model-based Off-policy Reinforcement Learning for Eco-Driving in Connected and Automated Hybrid Electric Vehicles

Zhu Zhaoxuan, Pivaro Nicola, Gupta Shobhit, Gupta Abhishek and Canova Marcello

Deep Reinforcement Learning (DRL) has recently been applied to eco-driving to intelligently reduce fuel consumption and travel time. While previous studies synthesize simulators and model-free DRL (MFDRL), this work proposes a Safe Off-policy Model-Based Reinforcement Learning (SMORL) algorithm for eco-driving. SMORL integrates three key components, namely a computationally efficient model-based trajectory optimizer, a value function learned off-policy and a learned safe set. The advantages over the existing literature are three-fold. First, the combination of off-policy learning and the use of a physics-based model improves the sample efficiency. Second, the training does not require any extrinsic rewarding mechanism for constraint satisfaction. Third, the feasibility of trajectory is guaranteed by using a safe set approximated by deep generative models. The performance of SMORL is benchmarked over 100 trips against a baseline controller representing human drivers, a nonlearning-based optimal controller, a previously designed MFDRL strategy, and the wait-and-see optimal solution. In simulation, SMORL reduces the

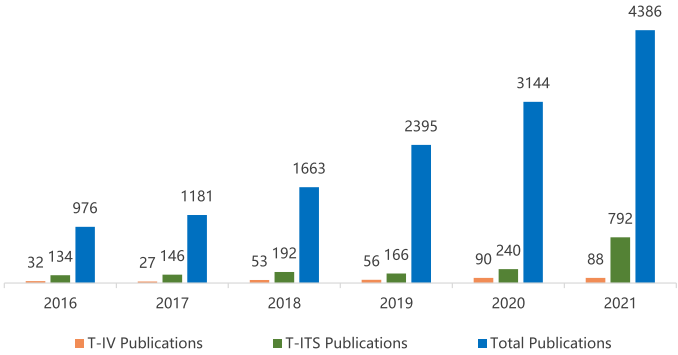

Fig. 1. Publications in the Field of Intelligent Vehicles.

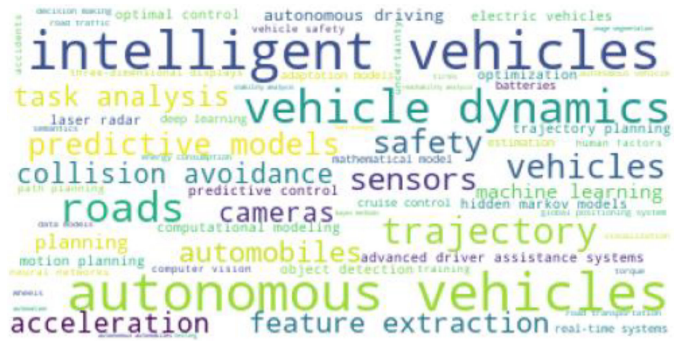

Fig. 2. The TIV Keywords Cloud.

fuel consumption by more than 21% while keeping the average speed comparable while compared to the baseline controller and demonstrates a better fuel economy while driving faster compared to the MFDRL agent and the nonlearning-based optimal controller.

II. THE STATE OF IEEE TIV

The field of intelligent vehicles is experiencing a tremendous growth over the last few years, and publications on this topic are still increasing rapidly, as illustrated in Fig. 1. As the first and only journal in IEEE with term "Intelligent Vehicles" in its title, we must take the leadership in this IV growth. However, in many aspects, IEEE TIV was an early-bird but didn't catch the worm, since only 2∼3% of those IV papers had been published in the TIV, indicating the significant potential for TIV's further development.

In future, I have commissioned a group of our associate editors and IV researchers to conduct an analysis of our published papers for information that could help us for the improvement of TIV which would will address a number of our concerns since the birth of this publication.

Content Analysis

As shown in Fig. 2 and TABLE I, "autonomous vehicles", "intelligent vehicles" and "vehicle dynamics" are the top 3 frequent keywords with the counts of 104, 102 and 69, respectively. In addition, "autonomous vehicles" had a burst in 2018, increased to 3 times the count in 2017, then remained stable between 2018-2021, which suggests the research on "autonomous vehicles" has been the hottest topics for TIV in the past 5 years and remained as a strong and continuing trend since.

TABLE I
MOST FREQUENT KEYWORDS IN THE IEEE T-IV

Rank	Keywords	Frequency
1	autonomous vehicles	104
2	intelligent vehicles	102
3	vehicle dynamics	69
4	roads	58
5	trajectory	45
6	vehicles	36
7	safety	34
8	sensors	33
9	predictive models	28
9	automobiles	28

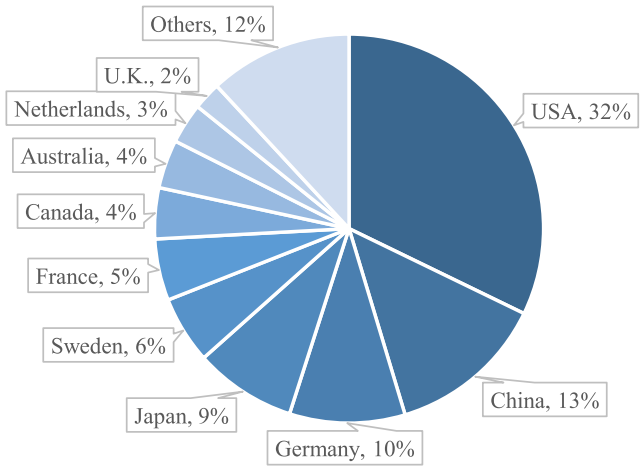

Fig. 3. TIV Contribution per Country/Region.

Contribution Analysis

Fig. 3 shows the country/region statistics according to the published paper counts. The U.S. ranks the first, and the next 2 top countries are China and Germany, and US and China combined have contributed 45% of the entire TIV publication.

Impact Analysis

The citation information is collected from the Web of Science Core Collection dataset in February 2022, and the top 10 highly cited papers in IEEE TIV is shown in Table II, indicating that only 3 TIV papers are cited more than 100 times. In the next few years, we need to find the effective mechanism and efficient approach to increase the impact of TIV in intelligent vehicle research and development.

TABLE II
THE MOST CITED PAPERS OF THE IEEE TIV

Rank	Title	Year	Cites
1	A Survey of Motion Planning and Control Techniques for Self-Driving Urban Vehicles	2016	544
2	Simultaneous Localization and Mapping: A Survey of Current Trends in Autonomous Driving	2017	222
3	A Review of Truck Platooning Projects for Energy Savings	2016	101
4	Looking at Humans in the Age of Self-Driving and Highly Automated Vehicles	2016	99
5	Lane Change and Merge Maneuvers for Connected and Automated Vehicles: A Survey	2016	95
6	How Would Surround Vehicles Move? A Unified Framework for Maneuver Classification and Motion Prediction	2018	89
7	Intelligence Testing for Autonomous Vehicles: A New Approach	2016	81
8	Understanding Pedestrian Behavior in Complex Traffic Scenes	2018	72
9	Automated Driving in Uncertain Environments: Planning with Interaction and Uncertain Maneuver Prediction	2018	63
10	Mixed-Integer Linear Programming for Optimal Scheduling of Autonomous Vehicle Intersection Crossing	2018	57

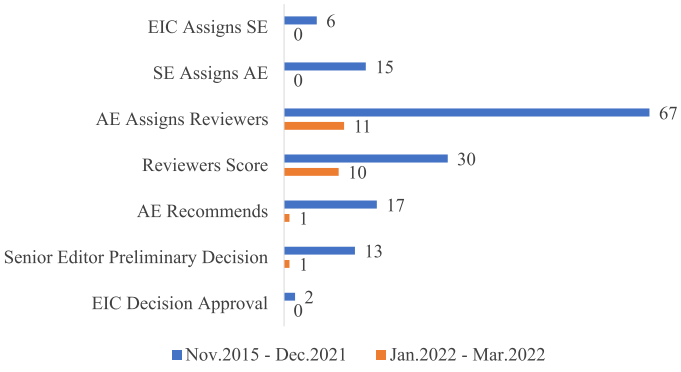

Fig. 4. The TIV Processing Time.

Review Process Analysis

To make IEEE TIV to be the flagship scientific publication and communication platform in the field of intelligent vehicles and smart mobility, we are now taking important steps to improve our review process. TIV's Editor-in-Chief and Senior Editors have made the DIDO Commitment: Day In and Day Out, and Associate Editors will follow the "3-2-2-4" 15 Weeks Guideline. Our new review policy and schedule have significantly reduced our review process time and increased its efficiency. As shown in Fig. 4, the processing time is much shortened after January 2022. Previous schedule took about 263 days on average to complete the entire review process and reach a final decision for a submission, while this number is reduced into 21 days in the first three months in 2022.

Call for Participation: Decentralized Hybrid Symposia for *IEEE TIV*

We at TIV are organizing decentralized and hybrid workshops or symposia (DHW or DHS) on various issues in Intelligent Vehicles. Welcome to participate in our investigations on-line or off-line in CPSS. Our discussions will be summarized and reported in our *Scan the Issue and Beyond* at *IEEE TIV*. Any suggestions or proposals for topics are greatly appreciated.

Let's Drive into the Future with Intelligent Vehicles, from here at IEEE TIV!

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REFERENCE

[1] F.-Y. Wang, "Metavehicles in the metaverse: Moving to a new phase for intelligent vehicles and smart mobility," *IEEE Trans. Intell. Veh.*, vol. 7, no. 1, pp. 1–5, Mar. 2022, doi: 10.1109/TIV.2022.3154489.