Editorial
Introduction to Responsible Artificial Intelligence for Autonomous Driving

ARTIFICIAL Intelligence is in transition as the fast convergence of digital technologies and data science holds the promise to liberate consumer data and provide a faster and more cost-effective way of improving human initiatives. Particularly, artificial intelligence (AI) is heavily influencing autonomous vehicles nowadays. The data driven-based AI autonomous vehicles have the potential to reshape the expectations of human's actions, the way that companies' stakeholders collaborate, and revamp business models in the various industries.

However, the use of data-driven-based AI comes with its own concerns that lead user distrust and ethical concerns. In fact, widespread access to consumer-generated information, along with inappropriate use of AI has brought negative impacts to individuals, organizations, industries, and society. For example, the collection and utilization of training data by AI algorithms gives rise to serious issues where consumers suffer from privacy invasion, fraud, ineffective and offensive, or lack of control over automated vehicles. Such ethical dilemma and concerns, if they are not well addressed when implementing AI for autonomous vehicles, not only influence negative impacts on vulnerable people, but also may lead to the potential loss of credibility for products and brands and hamper the company reputation.

To tackle these ethical challenges, the data protection regulations in many countries have come into force such as the Data Protection Act 2018, which is the U.K.'s implementation of the General Data Protection Regulation (GDPR) formulated by the European Union, and Act on the Protection of Personal Information (APPI) in Japan. These regulations have the potential to improve consumers' confidence in sharing personal information with engineers. Nevertheless, it may become a barrier to study responsible artificial intelligence for future autonomous driving.

From about 100 papers submitted to this Special Issue, finally, 32 high-quality articles were selected. Each article was peer-reviewed by two or more experts during the assessment process. The selected articles have exceptional diversity in terms of artificial intelligence and computer vision techniques and applications. They represent the most recent development in both theory and practice. The contributions of these papers are briefly described as follows.

In [A1], Wang et al. propose a behavior analysis pipeline including the modules of data preparation, trajectory coupling, motion scenario segmentation, and motion pattern measurement to capture the crowd information from micro-level and macro-level over the intelligent fabric space. It is the first automated behavior motion model to describe the status in the fabric space.

In [A2], Jin et al. propose a new aesthetic mixed dataset with classification and regression called AMD-CR, and train a meta reweighting network to reweight the loss of training data differently. In addition, they provide a training strategy according to different stages based on pseudo labels, and then use it for aesthetic training according to different stages in classification and regression tasks.

In [A3], Lan et al. propose a novel supervised hashing method, termed Label Guided Discrete Hashing (LGDH), which simultaneously preserves the comprehensive manifold structure and discriminative balanced codes that are both constructed by label information into Hamming space.

In [A4], Deng et al. propose an end-to-end degradation robust deep model, termed PcGAN, to classify traffic signs in a manner of few-shot learning. The proposed PcGAN models the joint distribution between the degraded traffic signal data and the corresponding prototypes from both degradation removal and generation perspectives by two alternating optimized modules, which ensures the generalization of the learned embedding of latent space for novel tasks.

In [A5], Zhou et al. present a novel encoder-decoder network, called BANet, for accurate semantic segmentation, where boundary information is employed as an additional assistance for producing more consistent segmentation outputs.

In [A6], Roitberg et al. enhance two activity recognition models often used for driver observation with temperature scaling—an off-the-shelf method for confidence calibration in image classification. Then, they introduce Calibrated Action Recognition with Input Guidance (CARING)—a novel approach leveraging an additional neural network to learn scaling the confidences depending on the video representation.

In [A7], Han et al. propose an AoI-oriented channel access strategy in the UAV-aided VEC network from the game theory viewpoint. First, the UAV-aided VEC network model and edge computing-based AoI expression are established and derived in the closed form, respectively. Subsequently, they transform the AoI minimization problem into an AoI-based channel access issue from the game theory viewpoint. Moreover, the stochastic learning-based algorithm is proposed to

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find the Nash Equilibrium (NE) solution of the formulated problem.

In [A8], Lu et al. propose a novel aspect-driven news recommender system (ANRS) built on aspect-level user preferences and news representation learning is proposed to enhance intelligent human–device interfaces in fully automated vehicles. At First, the proposed ANRS model devises a news aspect-level encoder and user aspect-level encoder to learn the fine-grained aspect-level representations of users' preferences and news characteristics, respectively. At last, these are subsequently fed into a click predictor to predict the probability of a given user clicking on the candidate news item.

In [A9], Gou et al. propose a new deep dictionary learning framework entitled the hierarchical graph augmented deep collaborative dictionary learning (HGDCDL). Equipped with a simple yet effective hierarchal graph construction mechanism, the HGDCDL uses the structure of data to regularize dictionary learning, and generates more informative dictionaries and discriminative representations at different levels.

In [A10], Zhao et al. propose a visible light mode dataset called the Dalian University of Technology Anti-UAV dataset, DUT Anti-UAV for short. It contains a detection dataset with a total of 10,000 images and a tracking dataset with 20 videos that include short-term and long-term sequences. All frames and images are manually annotated precisely. It uses this dataset to train several existing detection algorithms and evaluate the algorithms' performance.

In [A11], Djenouri et al. propose an intelligent hybrid framework for accident estimation, called HR2CNN (Hybrid RESNET and Convolution Neural Network for Accident Estimation). First, road states are collected, using an intelligent filter based on SIFT extractor and Chinese restaurant process to remove noise. The enhanced convolutional neural network is then used to identify the closer vehicles of each driver. The rest of the network benefits from vehicle detection to classify whether the current road condition could cause an accident or not. Finally, this method implements a novel optimization model with hyperparameters using evolutionary computation that can be used for parameter tuning of an indicated deep learning methodology.

In [A2], Liang et al. propose an object detection (OD) system based on edge-cloud cooperation and reconstructive convolutional neural networks, which is called Edge YOLO. It is a lightweight OD framework realized by combining pruning feature extraction network and compression feature fusion network to enhance the efficiency of multi-scale prediction to the largest extent.

In [A13], Chen et al. propose the updating Connected and Automated Vehicles (CAVs) model as the scanner of heterogeneous traffic flow, which uses various sensors to detect the characteristics of traffic flow in several traffic scenes on the roads. The model contains the hardware platform, software algorithm of CAV, and the analysis of traffic flow detection and simulation by Flow Project, where the driving of vehicles is mainly controlled by Reinforcement Learning (RL). Finally, the effectiveness of the proposed model and the corresponding swarm intelligence strategy is evaluated through simulation experiments.

In [A14], Taik et al. propose an optimized federated learning process for vehicular networks taking into consideration the non-iid and unbalanced aspects of data. The process utilizes vehicle-to-vehicle communication to bypass the communication bottleneck of federated learning, and incorporates a novel cluster formation algorithm based on data and mobility properties.

In [A15], Azadani and Boukerche propose a path prediction method based on the combination of temporal convolutional networks and mixture density layers to consider the inherited uncertainties of driving behavior. It deals with the problem of multimodal vehicle trajectory prediction at less structured but highly dynamic environments such as unsignalized intersections.

In [A16], Liu et al. propose dense blocks as the framework and introduced the attention mechanism to their model from four dimensions: multi-scale attention, channel attention, structure attention, and ROI (region of interest) attention. With the help of the training data provided by the weakly supervised model, the proposed method achieved excellent performance in the task of scattering medium imaging optimization in different scenes.

In [A17], Wang et al. propose how to use deep learning such as the pretraining mechanism of a transformer to dynamically model software sequence activities. Then this article uses graph modeling software's state log to capture the event association in the software activities and utilize a graph neural network (GNN) to learn the complex life activity rule of software. Finally, the above characteristics are deeply integrated.

In [A18], Li et al. propose a weakly supervised semantic segmentation network with iterative dCRF based on graph convolution. Specifically, it uses ResNet to generate CAMs and node features and then use graph convolution for feature propagation and merge the low-level and high-level semantic information of the image. Then execute dCRF in an iterative manner, and finally obtain refined pseudo-labels.

In [A19], Chen et al. propose a method to recognize the pavement texture using the deep learning approaches. The pavement texture data were first visualized using image processing methods, and then augmented using the traditional methods as well as a deep learning approach, i.e., Generative Adversarial Network (GAN) model. The Random Forest (RF) algorithm and the DenseNet network were both employed, where the overall classification accuracy of the original dataset was 50% and 59%, respectively, and the accuracy of the data augmented by the traditional methods was 58% and 70%, respectively.

In [A20], Zeng et al. propose a deep progressive feature fusion network for stereo matching. It exploits an encoder–decoder feature extraction network architecture for multi-stage and -scale dynamic feature extraction and enhancement. Moreover, it proposes a groupwise concatenation method to construct the cost volume, which provides a more efficient cost volume for cost aggregation.

In [A21], Wang et al. propose an alertness mechanism framework by using human alertness mechanism. Then, a fast K-T filtering algorithm is developed to eliminate noises of the electroencephalograph (EEG) signals. Third, the description problem of the directed interaction stability of the cortical EEG signals is solved. Fourth, the human alertness estimation is explored by using the support vector regression of the dynamically spatial–temporal brain network connection parameters.

In [A22], Xu et al. propose a Semantic Aligned Attention (SAA) mechanism to refine feature embedding in most of the existing embedding and metric-learning approaches for the few-shot classification problem. The proposed SAA mechanism highlights pivotal local visual information with attention mechanism and aligns the attentive map with semantic information to refine the extracted features.

In [A23], Khan et al. propose a multi-stage intrusion detection framework to identify intrusions from ITSs and produce low rate of false alarms. The proposed framework is based on normal state-based and a deep learning-centered bidirectional Long Short-Term Memory (LSTM) architecture to efficiently discover intrusions from the fundamental network gateways and communication networks of AVs.

In [A24], Tang et al. propose a multi-level query interaction model for the temporal language grounding task. Both the word- and phrase-level query semantics are captured by the proposed model. The experimental results on two different datasets demonstrate the superiority of the proposed model.

In [A25], Gao et al. propose a novel lightweight network using a multi-scale context fusion (MSCFNet) scheme, which explores an asymmetric encoder-decoder architecture to alleviate these problems. More specifically, the encoder adopts some developed efficient asymmetric residual (EAR) modules, which are composed of factorization depth-wise convolution and dilation convolution. Meanwhile, instead of complicated computation, simple deconvolution is applied in the decoder to further reduce the number of parameters while still maintaining the high segmentation accuracy.

In [A26], Wang et al. propose the concept of force translation for teleoperation systems consisting of dual hand master (left and right hands) manipulators and a single slave manipulator. Force translation reflects how the impedance on the single slave side is translated or allocated to contact forces on different master sides. To maintain the stability of the system and to improve transparency, it elucidates the mechanism of the force translation and analyze the relation among masters and the slave.

In [A27], Song et al. propose an adaptive two-stage merging neural network. By following the adaptive merging gate mechanism, the proposed network can effectively fuse the weighted visual features, the attentive text information and the global image topic information in two stages, while automatically calculating the proportions of these information when generating the corresponding word at each time step.

In [A28], Deng et al. propose a user behavior analysis model based on stacked autoencoder and unsupervised learning to address the disadvantages of user behavior analysis methods based on model-driven and causal analysis. On the basis of feature selection of user behavior datasets by using stacked autoencoder and clustering algorithm, the model also improves the performance of user behavior analysis by fusing the adaptive generation strategy of the initial cluster centers.

In [A29], Wei et al. propose resource allocation method in vehicular cloud computing (VCC) and fill the gaps in the previous research by optimizing resource allocation from both the provider's and users' perspectives. To solve such an NP-hard problem, it improves the nondominated sorting genetic algorithm II (NSGA-II) by modifying the initial population according to the matching factor, dynamic crossover probability, and mutation probability to promote excellent individuals and increase population diversity.

In [A30], Chen et al. propose a spatial–temporal clustering-based method. This method classifies regions into clusters and obtains approximate optimal point-to-point paths for UAVs such that all regions of interest would be covered correctly and efficiently, which is taking into consideration the influence of both flying features of UAVs and geographical locations of regions.

In [A31], Lou et al. propose a new type of automatic driving scheme, which links the wave height prediction with ship driving. By studying the accurate prediction of wave height, ships can adjust their course in real time to ensure that they always travel in the area with the lowest wave height. According to the different driving conditions of ships in the open sea and the offshore sea, the method designed two wave height prediction models based on LSTM, which are suitable for the above two types of sea areas.

In [A32], Yang et al. propose a new multi-class VLD dataset, called VLD-45 (Vehicle Logo Dataset), which contains 45000 images and 50359 objects from 45 categories respectively. The new dataset provides several research challenges involve in small sizes object, shape deformation, low contrast, and so on.

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HUIMIN LU, *Guest Editor*
Kyushu Institute of Technology
Fukuoka 804-8550, Japan

MOHSEN GUIZANI, *Guest Editor*
University of Idaho
Moscow, ID 83844 USA

PIN-HAN HO, *Guest Editor*
University of Waterloo
Waterloo, ON N2L 3G1, Canada

APPENDIX: RELATED ARTICLES

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