Mobile Networks and Applications (2023) 28:346–347
https://doi.org/10.1007/s11036-023-02095-w

Editorial: AI-based Data Intelligent for IoT Computing

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Published online: 14 July 2023

1 Editorial

The AI-based Data Intelligent for IoT Computing includes a bunch of emerging techniques in Artificial Intelligence for processing IoT data, such as machine learning algorithms design, collaborative network modelling, system performance analysis and parallel computing architecture application, as well as optimization algorithms in different computing layers. This special issue accepted seven papers for publication from open submissions. A summary of these accepted papers is outlined below.

The first paper titled “Intelligent Semantic Annotation for Mobile Services for IoT Computing from Heterogeneous Data” constructs a heterogeneous information network for service data, and proposes a new model named GoT, which fully utilizes the structural and semantic information. It contains four components, which are the metapath construction, the intra-metapath fusion, the inter-metapath fusion, and the semantic annotation recommendation. A real-world Web API dataset is collected, and the experimental results show that the model produces superior recommendation accuracy and alleviates the cold-start problem.

The second paper titled “Dense Attention Fusion Network for Object Counting in IoT System” devises the dense attention fusion network (DAFNet) in a divide-and-conquer manner. An iterative attention fusion (IAF) module, which mainly relies on the multiscale channel attention (MCA) unit, is designed to alleviate the side effect caused by background clutter. Meanwhile, to overcome the intrinsic scale variation, a dense spatial pyramid (DSP) module is built to consider the hierarchical information obtained under diverse receptive fields. And deformable convolution layers are applied to deal with the orientation arbitrariness. The synergy of the proposed IAF and DSP modules substantially promotes the effectiveness of the proposed DAFNet, and it is demonstrated by the notable superiority in extensive experiments on the remote sensing counting datasets against state-of-the-art methods.

The third paper titled “FP-RCNN: A real-time 3D target detection model based on multiple foreground point sampling for autonomous driving” proposes a real-time 3D target detection model based on multiple foreground point sampling for autonomous driving, FP-RCNN. A three-layer progressive sampling structure is used for key point sampling, and the third layer uses instance-aware downsampling to exploit semantic information to ensure that as many foreground points as possible are collected. Besides, the second stage divides the proposed box obtained in the first stage, fuses the contextual information of the original points to obtain the final point features, and outputs the confidence box through two fully connected layers. FP-RCNN is tested on the KITTI dataset, and the results show an improvement in pedestrian detection compared with a representative two-stage approach.

The fourth paper titled “Applying Probabilistic Model Checking to Path Planning for a Smart Multimodal Transportation System Using IoT Sensor Data” proposes probabilistic model checking based path planning for a multimodal transportation system. A traffic network with different means of travel is formalized as a directional graph, and the traffic congestion probability is generated from IoT sensor data. Besides, user-oriented critical paths are proposed, and the minimum cost and congestion requirements are defined in the form of probabilistic computation tree logic to describe the verification property for evaluating the selected path. In addition, the optimal path is identified and confirmed based on the quantitative results returned by the probabilistic model checker, PRISM, which is a supporting tool that verifies the property against the formal model. Case studies are conducted to demonstrate the feasibility and availability of our proposed method for the smart transportation system.

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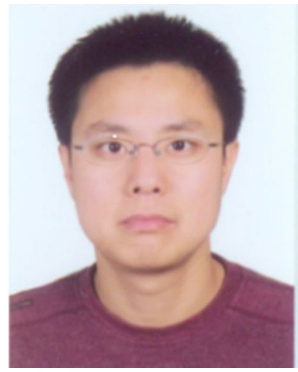
The fifth paper titled "6G Data Plane: A Novel Architecture Enabling Data Collaboration with Arbitrary Topology" proposes a Data Plane in the 6G network, which is independent of the existing User Plane, aiming at constructing data pipelines based on various data service requirements. It systematically provides the collaboration of data among multiple network components with arbitrary topology with the support for on-path-data processing. Besides, three data forwarding control protocols are proposed, guaranteeing the operation of the Data Plane by providing data forwarding in any topology. Simulation experiments demonstrate the good scalability and efficiency of the three protocols in the Data Plane.

The sixth paper titled "A Novel Variable Convolution Kernel Design according to Time-frequency Resolution Altering in Bearing Fault Diagnosis" leverages variable kernels to capture the time-frequency resolution altering nature within the non-stationary signals. Starting from the time-frequency characteristics of non-stationary signals, the theoretical basis of adopting variable convolution kernels is analyzed, and the impact of Heisenberg's measurement inaccuracy principle on the design of the learning framework is analyzed in-depth with wavelet analysis. Since the performance of different wavelet basis functions on time-frequency resolution varies dramatically, after a comprehensive study of the mutual relationship between these resolutions, proper criteria are deduced to deliver the measurement of performances, and the Gabor wavelet basis is chosen according to this principle. The practical experiments show that the proposed method outperforms other newly proposed classification methods in terms of achieving higher accuracy in less time.



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