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Editorial

Editorial for Special Issue on Emerging AI Technologies for Smart Infrastructure

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The continuously expanding urban environment introduces a significant amount of both physical and digital infrastructure. The accompanying solution that collects environmental big data through the Internet of Things (IoT) holds great promise, opening up new opportunities as well as challenges. On one hand, billions of sensors and devices continuously collect, process, and transmit data. The data volume poses the challenge for supporting the decision-making in an automatic and intelligent way. On the other hand, the dynamism of data, the complexity of the environment, and the diversity of tasks also set the barrier to the intelligent processing paradigm of smart infrastructure. Fortunately, recent advancements in AI technologies offer cost-effective solutions that are capable of substantially improving modern metropolitan smart infrastructure. This special issue focuses smart sensors, smart communications, smart analytics, and applications for smart infrastructure, introducing the relevant background and discussing potential beneficial technical routes. This special issue has collected seven excellent articles recognized by the reviewers and highly recommended by the editors.

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The first paper is "EMS2L: Enhanced Multi-Task Self-Supervised Learning for 3D Skeleton Representation Learning", authored by Lilang Lin, and Jiaying Liu. The paper introduces Enhanced Multi-Task Self-Supervised Learning (EMS2L) for 3D human skeleton-based self-supervised action recognition. EMS2L integrates multiple self-supervised tasks, including motion prediction, jigsaw puzzle task, and contrastive learning, to learn comprehensive information for enhanced feature representations. Extensive experiments on various datasets and network architectures demonstrates the proposed method outperforms previous ones in terms of generality and discriminative capabilities.

The second paper is "FOANet: A Feedback Operation-Attention Network for Single Image Haze Removal", authored by Chia-Lin Liu, Lei Chen, Ling Lo, Pin-Jui Huang, Hong-Han Shuai, Wen-Huang Cheng, Ching-Hsuan Wang, and Fan Chou. This paper addresses single image dehazing by mitigating image degradation caused by adverse atmospheric conditions. The Feedback Operation-Attention Network incorporates operation-attention blocks and curriculum learning with feedback to progressively refine features for generating haze-free images. The experiments demonstrate the superior dehazing performance to other methods.

The third paper is "SALVE: Self-Supervised Adaptive Low-Light Video Enhancement", authored by Zohreh Azizi and C.-C. Jay Kuo. The paper presents SALVE, a self-supervised method for enhancing low-light videos that combines retinex-based enhancement with learning-based ridge regression. SALVE demonstrates its effectiveness and efficiency through experiments and user studies, with 87% of participants' favoring tendency towards the method compared with previous methods.

The fourth paper is "PointFlowHop: Green and Interpretable Scene Flow Estimation from Consecutive Point Clouds", authored by Pranav Kadam, Jiahao Gu, Shan Liu, and C.-C. Jay Kuo. This paper introduces PointFlowHop, an efficient 3D scene flow estimation method that calculates flow vectors for individual points in the first point cloud. This approach offers a transparent mechanism compared to deep-learning methods. By optimizing network parameters in an end-to-end manner, the method achieves superior performance on the stereoKITTI and Argoverse LiDAR point cloud datasets with a smaller model size and shorter training time.

The fifth paper is "An Edge Lidar-Based Detection Method in Intelligent Transportation System", authored by Yung-Yao Chen, Hsin-Chun Lin, Hao-Wei Hwang, Kai-Lung Hua, Yu-Ling Hsu, and Sin-Ye Jhong. The paper introduces a novel LiDAR-based detection method, effectively enhancing 3D structural information to preserve detail while maintaining efficiency and low memory consumption. Experimental results demonstrate superior performance compared to state-of-the-art methods, particularly on the KITTI dataset, adapting to various vehicle detection classes.

The sixth paper is "Emerging AI Technologies for Smart Infrastructure", authored by Wen-Huang Cheng, Jenq-Neng Hwang, Ivan Bâjic, Rei Kawakami, Shiqi Wang, and Jiaying Liu. This forum article provides an overview of the panel discussion titled "Emerging AI Technologies for Smart Infrastructure," organized by the U.S. Local Chapter of APSIPA on April 24, 2022. The panel discussed two core themes: the current applications and the future trajectory of smart infrastructure. The initial focus centers on the key factors of the establishment of effective smart infrastructure. Subsequently, the panel shifts its gaze towards the future evolution of smart infrastructure and the potential challenges. These insights not only serve as valuable guidance but also inform the strategic development and deployment of smart infrastructure in the near future.

The seventh paper is "Real-time Vehicle Detection and Tracking on Fisheye Traffic Monitoring Video in Compressed Domain", authored by Sandy Ardianto, Hsueh-Ming Hang, and Wen-Huang Cheng. This paper aims to develop real-time vehicle detection and tracking techniques for fisheye traffic monitoring videos using the temporal information in the compressed domain. Two algorithms are proposed: One focuses on detection and tracking accuracy enhancement through multi-frame information fusion. The other emphasizes on multi-frame motion trail image construction and single-image multi-head detection. They achieve state-of-the-art accuracy in comparison to conventional video object detectors and trackers.

These papers featured in this special issue span a diverse spectrum of Emerging AI Technologies for Smart Infrastructure. These contributions highlight current limitations, introduce innovative solutions, and chart new directions for research in this rapidly evolving field. By delving into these insightful papers, our readers can gain comprehensive understanding of the latest advancements and potential applications in smart infrastructure technologies, while also finding inspiration for future research endeavors. We extend our sincere appreciation to our dedicated reviewers for their invaluable support and constructive feedback, which has greatly enriched this special issue.

Guest Editors

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