Editorial

Digital Twins: The Confluence of Virtual Reality With IoT

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Virtual reality (VR) and the Internet of Things (IoT) are two of the most important technologies to arise in the past decade or more. Taken individually, each technology represents a real sea change. VR has the potential to truly change the world in some surprising ways, while the IoT has already transformed the way we live our lives. Digital Twins is the confluence of these two developments, though, that offers the most promise and opportunity of all. VR applications promise to be the next mainstream business. They are used by companies in a wide range of industries, from product design to healthcare and employee training. At the same time, IoT platforms and related devices are much in demand in today's tech and business world. These smart devices connected to the Internet are capable of collecting, interpreting, and relaying data without human intervention or supervision.

The confluence of IoT with augmented and VR is nothing less than a revolution. It aims at merging the physical and digital world, not in a way where we can just see things, but one where we can give digital objects physical characteristics. This means the actual grounding of digital objects into physical environments and interacting with them in the same way we interact with physical objects. Since IoT is creating new ways of interacting with our environment, it lays down a multitude of advantages for enterprises to completely transform their business methods and their revenue models. So, the combination of VR and IoT will lead to increased productivity, accuracy, and security.

This special section aims to bring the latest results regarding VR and IoT techniques for various applications. It can help technicians to exchange the latest technical progress.

In the article "Digital Twins for Healthcare 4.0—Recent Advances, Architecture, and Open Challenges," Alazab et al. presented an overview and recent advances of digital twins for Healthcare 4.0. An architecture of digital twins for healthcare is also proposed. Furthermore, the authors present several use cases of digital twins, and finally present open research challenges with possible solutions.

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The authors of the article titled "Digital Twin Collaborative Platforms—Applications to Humans-in-the-Loop Crafting of Urban Areas" proposed digital twins as part of a convergence of technologies that may be put to good use to foster advanced distributed collaboration platforms to support humans in the loop. To clarify our proposal, they contextualize the proposed methodology by providing a conceptual framework related to a Virtual Hackable City, where they explain the advantages of such an approach.

In the article titled "Integrating Digital Twin and Advanced Intelligent Technologies to Realize the Metaverse," Aloqaily et al. discussed some of the key issues required in order to attain realization of metaverse services. Authors propose a framework that integrates digital twin (DT) with other advanced technologies, such as the sixth-generation (6G) communication network, blockchain, and AI, to maintain continuous end-to-end metaverse services. This article also outlines requirements for an integrated, DT-enabled metaverse framework and provides a look ahead into the evolving topic.

In the article "Secure Digital Twin Migration in Edge-Based Autonomous Driving System," Zhou et al. studied the efficient migration method of the DT model between the edge computing nodes inside the blackbox and proposed three different migration strategies depending on the source of the initial data and the source of the updated data, and evaluated the efficiency of these strategies in terms of migration time in different network environments using the autonomous driving simulation platform CARLA. We then derive methods for selecting migration strategies under different network conditions. During the migration process, there may be external attacks on participating elements or networks. The authors analyze the security problems that may arise during the migration process and propose corresponding defense methods against such cyberattacks.

In the article titled "Digital Twin-Based Cyber Range for Industrial Internet of Things," the authors propose a framework for a digital twin-based cyber range and a digital twin construction method with multiple models. Cyber ranges with digital twins are more flexible and convenient. Based on the proposed method, an industrial scenario is reproduced using machine learning algorithms to predict temperature changes from different perspectives.

In the article titled "Fast Monocular Visual Odometry for Augmented Reality on Smartphones," Cao et al. proposed a fast visual odometry system for smartphones, the presented system called FastVO. The FastVO consists of feature tracking, relative pose estimation, and trajectory construction.

In the article titled "Stereoscopic Video Quality Assessment in the Context of Internet of Things," an effective quality assessment method is proposed by Zhao et al. to accurately determine the quality of information. Specifically, for a large amount of stereo video data, the representative sequence of stereo video is extracted to reduce the data volume. Inspired by binocular channel theory, operators of the difference map and the novel fusion map are executed on these sequences. Then, a dynamic texture descriptor, known as volume local binary pattern, is employed to represent the spatio-temporal domain to predict the stereo video quality.

In closing, the Guest Editors would like to thank all the authors who significantly contributed to this special section and the reviewers for their efforts in respecting deadlines and their constructive reviews. We thank the authors for their contributions, the reviewers for their valuable work, and the editorial team of the journal for their professional support and collaboration.

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