

Blockchain-based Federated Learning Approaches in Internet of Things applications

Yuanchao HU¹, Xinhai LI², Lingcheng ZENG², Yunzhu AN¹, Jinsong YANG², and Xing XIAO²

¹Shandong University of Technology

²Guangdong Power Grid Corp

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Abstract

The Internet of Things (IoT) is a new well-structured emerging technology with communication of smart devices using the 5G technology, infrastructures of roads, vehicles, smart cities, traffic systems and user applications. The IoT applications facilitate providing prompt emergency responses, and improved quality of vehicles, and road services, with cost-effective activities in the intelligent transportation systems. According to the growth of 5G technology and complex communications between smart devices and intelligent vehicles, Federated Learning is applied to support privacy and security factors in safety-critical transportation systems using innovative prediction methods in Internet of Vehicle (IoV) environments. Therefore, Federated Learning (FL) approaches can support safety, privacy and security for the sensitive personal information of users and critical aspects of vehicles in intelligent transportation systems and IoV. This comprehensive review paper delves into the innovative integration of blockchain technology with federated learning and the dynamic domain of IoV. It extensively analyzes the primary concepts, methodologies, and challenges associated with the deployment of FL in IoV. This study categorically examines three main types of federated learning approaches vertical, horizontal, and decentralized each tailored to specific IoV communication scenarios like Vehicle-to-Vehicle (V2V), Vehicle-to-Infrastructure (V2I), and Vehicle-to-Cloud (V2C). The study emphasizes various applications of FL, including cyber-attack detection, data sharing, traffic prediction, and privacy preservation based on critical Quality of Service (QoS) factors. Finally, some main challenges and new open issues are discussed and assessed for federated machine learning approaches in the IoV.

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