A Study on the Joint Optimization of Resource Allocation and Partial Task Offloading for Vehicular Federated Learning Systems

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서식 있음: 왼쪽, 들여쓰기: 왼쪽: 0 cm

Abstract

Intelligent Transportation Systems are comprised of Intelligent Connected Vehicles (ICVs) that enhance travel efficiency and safety. However, there exists hardware and power limitations of ICVs in adapting the requirements of resource-hungry autonomous driving. Multi-access Edge Computing is an emerging technology that helps overcome these limitations effectively. This work investigates the vehicle-to-edge server task offloading problem that optimizes trade-offs in resource allocation and partial offloading. Unlike the centralized approach that requires information of all transmission links in the system, this study design a distributed solution that directly confronts the multi-variable and non-convex challenges by decoupling variables and using bounding constraints to guide the controlof task offloading and resource allocation. We propose a novel low-complexity algorithm that not only achieves optimal solution but also demonstrates the real-time efficiency and applicability, illustrated through the simulation results under genuine vehicular edge computing settings. The achievable performance practically reinforces the relevance and soundness. Moreover, we propose to integrate the distributed algorithm with a federated learning framework to build a leading-edge application, substantiating enhancements in computational robustness and efficiency.

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Ⅰ. Introduction

Intelligent Transportation Systems are comprised of Intelligent Connected Vehicles (ICVs) that enhance travel efficiency and safety [1]. However, there exists hardware and power limitations of ICVs in adapting the requirements of resource-hungry autonomous driving. Multi-access Edge Computing is an emerging technology that helps overcome these limitations effectively. This work investigates the vehicle-to-edge server task offloading problem that optimizes trade-offs in resource allocation and partial offloading.

Ⅱ. Method

Unlike the centralized approach that requires information of all transmission links in the system [2] and [3], this study design a distributed solution that directly confronts the multi-variable and non-convex challenges by decoupling variables and using bounding constraints to guide the controlof task offloading and resource allocation. We propose a novel low-complexity algorithm that not only achieves optimal solution but also demonstrates the real-time efficiency and applicability, illustrated through the simulation results under genuine vehicular edge computing settings.

Ⅲ. Conclusion

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The achievable performance practically reinforces the relevance and soundness. Moreover, we propose to integrate the distributed algorithm with a federated learning framework to build a leading-edge application, substantiating enhancements in computational robustness and efficiency..

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