Resource Allocation and Migration in High Speed Railway Using Mobile Edge Computing Technology

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***Abstract*— In the environment of HSR (High-Speed Railway), a large amount of computation-intensive and delay-sensitive tasks are generated and MEC (Mobile Edge Computing) technology is essential to process them according to the requirements of tasks. However, effective resource allocation is important in a complex HSR environment with limited computing resources of MEC server. The characteristic of DRL (Deep Reinforcement Learning) that doesn't require prior knowledge is very useful in domains with high-dimensional states and actions like HSR. In this paper, we examine DRL-based approaches to identify potential directions for future research.**

Keywords— Mobile Edge Computing, High Speed Railway, Deep Reinforcement Learning

I. INTRODUCTION

Nowadays, vehicles are increasing exponentially, resulting in computation-intensive and delay-sensitive tasks. Existing vehicles are difficult to completely process the requirements of the task due to their limited computing capacity. Thus cloud computing technology is used to solve these problems. However, cloud computing servers are far from vehicles, resulting in longer delays [1]. For this reason, MEC (Mobile Edge Computing) technology attracts a great deal of interest. MEC technology is a promising technology for delay-sensitive tasks because it reduces delay by shortening the distance between the vehicles and the cloud computing server. However, since MEC servers have limited computing resources compared to cloud computing servers, it is important to allocate the resources efficiently according to the requirements of the tasks.

Especially, HSR environment has higher mobility than the existing vehicle environment [2]. In addition, HST(High Speed Train) generates a large number of computation-intensive and delay-sensitive tasks simultaneously. This is because the demand for task processing is much higher than that of the vehicle environment due to the feature of the train environment in which many passengers are on board with a high density. The resource allocation of MEC servers is crucial in order to serve numerous delay-sensitive and computation-intensive tasks in this environment. In addition, research on migration is essential to ensure that vehicles with mobility are supported continuously. Therefore, in this paper, we would like to examine approaches based on DRL to solve the MEC server resource allocation problem.

II. RESEARCH APPROACHES USING DRL TECHNIQUE

DRL-based approaches have received a lot of attention in recent years because they do not require accurate prior information of system models in dynamic and complex environments such as HSR environments. [3] presents an effective resource allocation algorithm for MEC-based HSR environment, aiming to reduce the overall computation cost. This algorithm proposes a combination of DDQN (Double Deep Q-Network) that performs subcarrier assignment decision and DDPG (Deep Deterministic Policy Gradient) that plays a role of making offloading ratio, power allocation, and computation resource allocation decision. In addition, [4] allocates channel resources and edge computation resources while achieving task offloading and migration using DDPG. In the paper, channel resource allocation between MEC servers for migration is considered. [5] investigates power allocation algorithm based on MADRDPG (Multi Agent Deep Recurrent Deterministic Policy Gradient), which demonstrates good performance in terms of spectrum efficiency and execution latency. [6] uses DDQN to achieve computation resource allocation, task offloading, and power allocation. Because a one-way straight road without an intersection is used, it limits the consideration of practical and complex scenarios.

III. CONCLUSION

Recently, the use of MEC servers has been receiving a lot of attention to process a large number of computation-intensive and delay-sensitive tasks occurring in HSR environments. However, effective resource allocation is important because the MEC server has limited computing capability. In order to solve the problem, techniques based on DRL are being extensively considered. In this paper, we have designed future research directions by analyzing the characteristics of these studies.

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