Providing a Framework for Cloud-Edge-Dew Enabled IOT Environment Using the Hybrid DQN-Attention-BILSTM Algorithm to Reduce Response Time and Energy Consumption

Abstract

With the emergence of a new generation of communication networks, we are witnessing a wide-ranging transformation and the emergence of very diverse applications in the field of Internet of Things. Devices connected to the IOT environment usually have limitations in processing power and energy, which has made these devices unable to execute applications with high processing power and real-time. Offloading computational tasks to cloud and edge servers has been introduced as a solution to this challenge. However, the remoteness of cloud servers causes high transmission delay, which is inconsistent with the RealTime nature of tasks in this area. Also, loading all tasks of IOT devices onto the edge environment due to the resource limitations of edge servers causes long queues and delays in execution time.

Therefore, in this paper, we present a general framework for reducing response time and energy consumption in the IoT environment. In this framework, first, by scaling the resources of edge servers using the BILSTM algorithm, we improve the allocation of resources to tasks to minimize the execution time and waiting time for tasks to receive resources. Next, we select the appropriate location for executing tasks using the Attention-DQN algorithm, considering the amount of computational resources and the deadline of the tasks. The execution location can be the IoT device itself that creates the task, Dew devices, an appropriate edge server, or a cloud server. With this distribution of tasks, IoT devices can save energy consumption. Finally, if we decide to execute on cloud servers, we use the Caching technique to reduce execution time. In fact, by simultaneously reducing the transmission time, waiting time, and execution time, we try to reduce the response time. Evaluation of the proposed framework shows that this method can effectively reduce the response time delay by up to 29.4% and energy consumption by up to 22.8%.

Keywords: IOT, response time, energy consumption, Attention-DQN algorithm and BILSTM algorithm