

ABSTRACT

The rapid proliferation of mobile devices and the increasing demand for low-latency services have led to the emergence of Mobile-Edge Computing (MEC) as a viable solution to these challenges. MEC brings computation and storage closer to end-users, reducing latency and improving the overall user experience. However, MEC environments' dynamic and resource-constrained nature poses significant challenges in optimizing offloading decisions. Traditional deep reinforcement learning (DRL) algorithms, while effective, often introduce considerable computational overhead, making them less suitable for resource-limited MEC systems.

In this study, we propose a novel approach to optimize offloading decisions in MEC by modifying the Nadam optimizer, resulting in a new version termed MyNadam. The key modification involves removing the `u_product` component to reduce computational complexity while maintaining convergence speed and stability. We evaluate MyNadam against several existing optimizers, including Adam, Adadelta, Adagrad, Adamax, Nadam, and Ftrl, under various scenarios with different iteration counts and user loads. The experiments are designed to assess the efficiency, stability, and overall performance of these algorithms in dynamic MEC environments.

The experimental results demonstrate that MyNadam outperforms traditional optimizers in several key aspects under both normal and alternate load conditions. Specifically, under normal load, MyNadam achieved a normalized computation rate of 0.9935 at 2000 iterations, while significantly reducing the total time consumed and average time per channel compared to Adam and Nadam. In alternate load scenarios, MyNadam maintained a normalized computation rate of 0.9955 and continued to demonstrate superior efficiency by minimizing computational time and maintaining stability across various user loads. These improvements confirm that MyNadam is not only effective in optimizing offloading decisions in MEC but also adaptable to varying computational demands, making it a robust solution for resource-constrained environments.

Keywords: Mobile-Edge Computing, Deep Reinforcement Learning, Nadam Optimizer, Optimization Algorithms