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Fault-tolerance-aware flexible and mobility-aware task offloading based on machine learning in mobile cloud computing

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Abstract

Mobile edge computing (MEC) improves resource-limited mobile devices by transferring demanding computational activities to edge servers and cloud infrastructure, thereby mitigating issues related to user mobility and network fluctuations. This paper introduces Flexible Mobility-Based Task Offloading (FlexiMRO), a mobility-oriented, fault-tolerant framework for adaptive task offloading in MEC and cloud settings. The suggested methodology incorporates a long short-term memory model to forecast user trajectories and network states with high transmission precision, alongside a deep reinforcement learning strategy utilizing Q-Deep networks for optimal job distribution at the edge and cloud layers. A random forest classifier guarantees fault tolerance by accurately predicting server failures and facilitating the reallocation of ongoing jobs. Comprehensive simulations illustrate the superiority of FlexiMRO compared to current methodologies, achieving a latency reduction of up to 70%, an enhancement in energy efficiency of 60%, and a failure rate of 80% in contrast to 70%. FlexiMRO offers a scalable and adaptable solution for 5G and IoT applications by minimizing latency, energy consumption, and quality of experience, efficiently utilizing edge and cloud computing to guarantee uninterrupted service delivery in dynamic MEC environments.

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