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# PERFORMANCE EVALUATION OF ENERGY-EFFICIENT TASK SCHEDULING IN CLOUD-EDGE COMPUTING ENVIRONMENTS

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## *ABSTRACT*

*The rapid growth of cloud computing, edge intelligence, and latency-sensitive digital services has increased the need for task scheduling strategies that can simultaneously satisfy computational requirements, response-time constraints, and energy-efficiency objectives. Conventional cloud-centric scheduling approaches often transfer a substantial volume of computational tasks to centralized data centres, resulting in increased communication overhead, network congestion, and energy consumption, particularly when applications generate workloads continuously from geographically distributed devices. This research presents an energy-efficient task scheduling approach based on reinforcement learning for cloud-edge computing environments, where computational tasks are dynamically assigned among edge nodes and cloud resources according to their workload characteristics, processing capabilities, communication conditions, and energy requirements. The proposed approach formulates task scheduling as a sequential decision-making problem in which the reinforcement learning agent observes the current state of the computing environment and selects an appropriate resource allocation action. The learning process considers multiple scheduling parameters, including task execution time, node utilization, transmission delay, computational capacity, queue length, and estimated energy consumption. A reward mechanism is designed to encourage decisions that reduce unnecessary energy expenditure while maintaining acceptable latency and resource utilization. By continuously learning from scheduling outcomes, the proposed method can adapt to variations in workload intensity and changing resource availability without relying entirely on fixed scheduling rules. The effectiveness of the approach is assessed using performance indicators such as total energy consumption, task completion time, execution latency, resource utilization, task acceptance rate, and scheduling efficiency. The expected results demonstrate that reinforcement-learning-based scheduling can provide a more balanced allocation of workloads between cloud and edge resources than conventional scheduling strategies. Processing suitable tasks closer to data sources can reduce communication distance and unnecessary data transfers, while computationally intensive tasks can be directed toward more capable cloud resources when appropriate. The study consequently establishes reinforcement learning as a promising mechanism for achieving adaptive and energy-conscious task scheduling in heterogeneous cloud-edge environments. The proposed framework can contribute to sustainable computing by reducing energy wastage while preserving the responsiveness and reliability required by modern distributed applications.*

***KEYWORDS:*** *Energy-Efficient Computing; Reinforcement Learning; Task Scheduling; Cloud-Edge Computing; Resource Allocation*