Improved Butterfly Optimization Algorithm for Data Placement and Scheduling in Edge Computing Environments

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Abstract

Mobile edge computing (MEC) is an interesting technology aimed at providing various processing and storage resources at the edge of mobile devices (MDs). However, MECs contain limited resources, and they should be appropriately managed to prevent resource wastage. Workflow scheduling is a process that tries to map tasks to the most proper set of resources based on some objectives. This paper presents DBOA, a discrete version of the Butterfly Optimization Algorithm (BOA) that applies the Levy flight method to improve its convergence speed and prevent local optima problems. We also employed a task prioritization method to find the task execution order in the scientific workflows. Then, we use DBOA for Dynamic Voltage and Frequency Scaling or DVFS-based data-intensive workflow scheduling and data placement in MEC environments. For evaluating the performance of the proposed scheduling scheme, extensive simulations are conducted on various well-known scientific workflows with different sizes. The obtained experimental results indicate that our method can outperform other algorithms in terms of energy consumption, data access overheads, and so on.