Fog computing task scheduling

a multi-objective AI-based approach

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Abstract

Introduction

As the number of devices grows exponentially, the demand for computing resources increases. The traditional cloud computing model is not sufficient to handle the massive amount of data generated by these devices. Fog computing is an alternative model that extends the computing resources to the edge of the network, closer to the devices. This model reduces the latency and bandwidth usage, and improves the overall performance of the system. However, the increasing demand for computing resources also raises concerns about the energy consumption and the environmental impact of fog computing systems.

In this paper, we will propose an AI-based task scheduling algorithm that integrate the use of green energy sources while satisfying the Quality of Service (QoS) requirements of the users.

The rest of this paper is organized as follows. In Chapter 2, we present an overview of the existing research on task scheduling, energy efficiency and AI in the context of fog computing. In Chapter 3, we describe the proposed task scheduling algorithm and the integration of green energy sources. In Chapter 4, we present the experimental results and the performance evaluation of the algorithm. Finally, in Chapter 5, we conclude the paper and discuss the future work.

Related Work

There are many existing studies and researches on the topics task scheduling, energy efficiency and AI in the context of fog computing. The concept of fog computing was introduced by Cisco in 2012 [1], and since then, many researches have been conducted to improve the performance of fog computing systems and reduce their environmental impact.

Fog computing

Fog computing is a paradigm that extends cloud computing and services to the edge of the network. [2] and [3] respectively investigate the concepts surrounding fog and its applications in the context of IoT. [4] offers an extensive review of the existing work on fog computing.

Task Scheduling in Fog Computing

Genetic Algorithms

The task scheduling problem in fog computing has been widely studied in the literature. Many researchers have proposed different algorithms and techniques to optimize the task scheduling process in fog computing systems. [5] offers an analysis of the existing algorithms while identifying the challenges and research gaps. In [6], the authors propose a task scheduling algorithm based on Swarm Intelligence and Machine Learning. This hybrid approach minimizes the execution time and the makespan and improves the performance of the load balancing scheduling. In [7], an optimization model is proposed for the problem of mapping data stream over fog nodes while considering the load of those nodes and the latency between the sensors and the nodes. A heuristic based on genetic algorithms is then presented to address the complexity of the problem. In [8], the authors propose a task clustering and scheduling mechanism based on Differential Evolution to find the optimal execution time for the tasks. The mechanism is compared to the Firefly Algorithm and Particle Swarm Optimization, and the results show that the proposed mechanism outperforms the other two algorithms in terms of execution time, system efficiency and stability.

Fuzzy Logic

[9] proposes a ranking-based task scheduling method that combines fuzzy logic and user preferences. In [10], the authors propose an approach based on Fuzzy Logic for real-time task scheduling in IoT applications.

Energy Efficiency in Fog Computing

The energy efficiency of fog computing systems has been a major concern for researchers. [11] introduces a mathematical framework to evaluate the trade-off of fog computing systems, especially in terms of power consumption and energy efficiency. In [12], the authors propose two Integer Linear Programming models, where the second one aims at minimizing the energy consumption while maximizing successfully provisioned tasks. The authors of [13] provides an overview of the energy efficiency challenges in fog computing and presents a comprehensive survey of the existing energy-efficient techniques and algorithms. An energy-aware Metaheuristic algorithm based on the Harris Hawks Optimization algorithm, itself based on a local search strategy for task scheduling in fog computing, is proposed in [14]. [15] proposes an energy efficient algorithm through an integrated computation model.

AI in Fog Computing

The use of AI in fog computing has been a growing trend in the literature. An efficient binary CNN with numerous skip connections is proposed by the authors of [16]. In [17], the authors designed an intelligent energy-saving model based on CNN and a task scheduling model is designed based on the policy gradient algorithm. [18] present an improved convolutional neural network so solve the value function of a Continuous Markov Decision Process model, so it can be applied to a multi-user system.

Travail réalisé

Réalisation

Conclusion

Conclusion

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