IOSR Journal of Multidisciplinary Research (IOSR -JMR)
ISSN: 3048-7439 Volume 2, Issue 2, Series 2, Mar. - Apr. (2025), PP 28-29
www.iosrjournals.org

Deep Reinforcemeant Learning In Resource Management In MEC

Abishek Rosin A, S. Sudha
Department Of Computer Applications,
Hindustan Institute Of Technology And Science, Chennai, India

Abstract
Mobile Edge Computing (MEC) is a transformative paradigm that enhances computational efficiency by bringing processing and storage capabilities closer to the end-user. This significantly reduces latency and improves performance in applications such as IoT, augmented reality, and real-time data processing.
However, efficient resource management remains a critical challenge to optimize utilization, maintain Quality of Service (QoS), and ensure energy efficiency in dynamic and heterogeneous environments. This paper presents a comprehensive survey of resource management techniques in MEC, analyzing key challenges such as scalability, load balancing, and security. We categorize existing strategies into static and dynamic resource allocation models, highlighting their effectiveness in real-world deployments. Additionally, we propose a computing resource allocation method based on energy iteration and system utility, demonstrating its efficiency through simulations using VB.NET software. The results indicate improved network throughput and system utility while optimizing energy consumption.

Keywords: *Mobile Edge Computing (MEC), Internet of Things (IoT), Augmented Reality (AR), Quality of Service (QoS), Deep Reinforcement Learning, Minimum Energy Consumption.*

Date of Submission: 01-04-2025 Date of Acceptance: 11-04-2025

I. Introduction

Mobile Edge Computing (MEC) extends cloud capabilities to the network edge, reducing latency and improving bandwidth utilization for real-time applications like AR, autonomous vehicles, and IoT services. Effective resource management is critical for ensuring optimal performance, balancing energy efficiency, and maintaining QoS. This paper explores intelligent task offloading techniques, load balancing strategies, network resource allocation, and security challenges in MEC environments.

II. Literature Survey

Existing studies on MEC resource management focus on diverse areas, including computational resource allocation, bandwidth optimization, and AI-driven decision-making for workload distribution. Notable approaches include:

- **Dynamic Priority Scheduling**: Assigns task priorities based on system context and urgency to optimize resource allocation.
- **SpACCE Framework**: Estimates computational capacity for efficient workload handling.
- **Mobile Cloud Computing (MCC) Solutions**: Investigates task offloading challenges and bandwidth limitations.
- **Deep Reinforcement Learning (DRL) Methods**: Utilized for adaptive scheduling and workload optimization.

III. Methodology

To enhance resource management in MEC, we propose an optimized deep reinforcement learning (DRL) algorithm that dynamically balances computational tasks between local devices and edge servers. Our approach includes:

- **Task Scheduling Mechanisms**: Allocating workloads based on network conditions and system capacity.
- **Hybrid Resource Management**: Distributing workloads intelligently between cloud and edge layers.
- **Energy-Efficient Computing**: Implementing dynamic voltage and frequency scaling (DVFS) for power conservation.

A. Algorithm - Deep Reinforcement Learning

Our DRL-based model consists of:

1. **Agent**: Learns and interacts with the MEC environment.

2. **State & Action Space**: Represents system status and possible decisions.
3. **Reward Function**: Evaluates efficiency and energy consumption.
4. **Policy Optimization**: Improves task allocation strategies iteratively.

IV. Experimental Results

The proposed framework was implemented using VB.NET to simulate MEC environments. Key observations include:

- Increased **network throughput** with optimized resource allocation.
- Reduced **latency** and improved QoS under variable network loads.
- Higher **system utility** achieved through adaptive scheduling strategies.

A. Performance Analysis

We compared our DRL-based approach with conventional routing protocols (AODV, NCPR). Results showed significant improvements in:

- **Packet Delivery Rate**
- **Bandwidth Utilization**
- **Energy Efficiency**

V. Conclusion

Efficient resource management is crucial for MEC systems, balancing computational loads while optimizing energy efficiency. Our DRL-based model enhances real-time task scheduling and workload distribution, ensuring improved performance and QoS across diverse applications. Future work will explore advanced AI-driven strategies for further optimization.

References

[1] B. G. Chun, S. Ihm, P. Maniatis, M. Naik, And A. Patti, "Resource Management In Mobile Edge Computing," Eurosys, 2022.
[2] R. K. Balan Et Al., "Dynamic Priority Scheduling Based On Task Urgency And System Context," Ieee Cloud Computing, 2022.
[3] E. Cuervo Et Al., "Spacce: Capacity Calculation For Edge Computing," Mobisys, 2022.
[4] M. Satyanarayan, "Fundamental Challenges In Mobile Cloud Computing," Acm Podc, 2022.
[5] G. Huerta-Canepa, D. Lee, "A Virtual Cloud Computing Provider For Mobile Devices," Acm Mcs, 2023.