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Chapter 36

Hybrid Optimization and Machine Learning Approaches for Enhanced 5G Network Slicing with Improved QoS and QoE

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Summary

Network slicing is a critical technique in 5G networks that allows for the creation of multiple virtual network instances that are customized to meet the needs of each customer. Each slice functions as a distinct entity with its own unique attributes, including bandwidth and Quality of Service (QoS). This feature enables the dynamic allocation of network resources to optimize performance in accordance with the specific requirements of each user. In this paper, we suggest a hybrid optimization and machine learning approach to improve the slicing of 5G networks, thereby enhancing both the Quality of Service (QoS) and the Quality of Experience (QoE). The methodology begins with a U-Net architecture optimized using Whale Optimization (Whale-U-Net) for deep feature extraction from 5G network slicing datasets. Subsequently, a hybrid meta-heuristic algorithm, Backtracking Search with Quantum Newton Optimization (BS-QNO), is introduced to select optimal features. In order to assess the influence of network slicing, we incorporate deep learning models, including Long Short-Term Memory (LSTM) and Recurrent Neural Networks (RNNs), as well as machine learning classifiers, including Decision Trees (DTs) and Support Vector Machines (SVMs). Ultimately, the most desirable classification outcomes are optimized through the implementation of a novel Deep Recurrent Reinforcement Learning (DRRL) methodology for network slicing classification. Open-source benchmark datasets are implemented to verify the proposed methodology. The results illustrate the efficacy of the proposed approach in enhancing performance metrics and optimizing 5G network slicing.

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