ABSTRACT

Radio resource modelling and allocation in heterogeneous networks (HetNets) is an important aspect in modern wireless communication technologies. HetNets consist of microcells, macrocells, picocells, femtocells which can increase network capacity and spectrum efficiency by reducing power consumption, but pose challenges in interference management and resource allocation. Various algorithms such as auction, greedy, and round robin, as well as clustering techniques from machine learning, have been proposed to address these issues. These approaches help manage network traffic more efficiently, reduce interference, and maximise throughput.

In this research, a system model consisting of one Macro Base Station (MBS), four Small cell Base Stations (SBS), and several Small cell User Equipment (SUE) are randomly distributed. The communication scheme used in this system model is a downlink scheme. The RB allocation process uses greedy algorithm, auction algorithm, and round robin algorithm and is applied in K-Medoids and fixed clustering system models. This research evaluates the performance of various clustering methods in network performance management and optimisation, focusing on data rate, total sum rate, spectral efficiency, power efficiency, and fairness.

The Greedy Fixed Clustering method showed the best performance, achieving an average data rate of 1.742×10^7 bps and total sum rate of 1.260×10^9 bps, with the highest spectral efficiency of 3.284 bps/Hz and power efficiency of 1.729×10^7 bps/W. The Greedy K-Medoids Clustering method also shows good performance with an average data rate of 1.721×10^7 bps and a total sum rate of 1.230×10^9 bps. In the scenario of increasing radius coverage, Greedy Fixed Clustering still excels with a data rate of 1.298×10^7 bps and a total sum rate of 4.78×10^9 bps. The Auction Fixed Clustering method shows competitive performance with a data rate of 1.214×10^7 bps and a total sum rate of 4.635×10^9 bps. Round Robin K-Medoids Clustering method has the lowest performance in all scenarios. Overall, Greedy Fixed Clustering is the most effective and efficient method in optimising network performance, while Auction Fixed Clustering also shows potential in some aspects. This research has not reached the target value set. Therefore, it is necessary to optimize and add parameters that can be carried out in further research.

Keywords: Resource block, greedy algorithm, auction algorithm, and round robin algorithm.