

The influence of different clustering method on graph coloring algorithm in Ultra-dense RAN

Chang Ge^{†1} Sijie Xia^{†2} Qiang Chen^{†3} Fumiyuki Adachi^{†4}

^{†1, 2, 3} Department of Communications Engineering, Tohoku University

^{†4} Research Organization of Electrical Communication, Tohoku University

1. Introduction

Recently, we proposed a two-layer clustering algorithm to alleviate the computational complexity problem of large-scale multi-user MIMO (MU-MIMO) in ultra-dense RAN [1]. Our proposed clustering algorithm can realize two clustering methods (i.e., antenna and user-based clustering methods). However, clustering brings in strong inter-cluster interference in each base station (BS) coverage area [2]. In order to mitigate the inter-cluster interference, we proposed a graph coloring based interference coordination algorithm named Restricted Color Number (RCN) algorithm [1]. In this paper, we compare the two clustering methods jointly used with graph coloring algorithm.

2. Simulation Results

Figure 1 illustrates an example of 96 users, 128 antennas and 8 clusters for ultra-dense RAN with zero-forcing (ZF)-based distributed MU-MIMO when applied user-based and antenna-based clustering methods, the different color represents different frequency after utilizing our proposed RCN graph coloring algorithm.

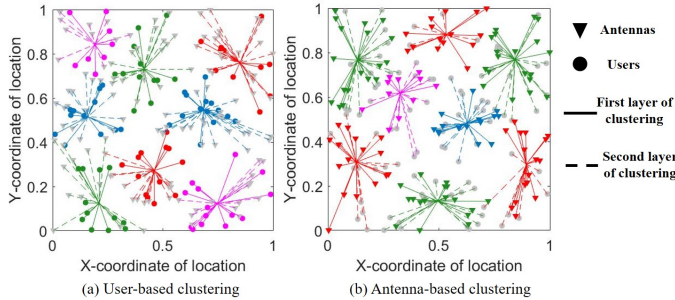


Fig. 1. Results of different clustering method for 96 users, 128 antennas, and 8 clusters when applied RCN graph coloring algorithm

Figure 2 plots the sum link capacity obtained by computer simulation as a function of the number of users for 4 different antenna location patterns. Similar to our previous study [1], the number of cluster is 8 and the number of antennas remains 128. For the no coloring case, the user-based clustering (black lines) always provides higher link capacity than the antenna-based clustering method (gray lines). When graph coloring is jointly used, the link capacity curves for user-based clustering (dark green lines) are more concentrated than antenna-based clustering (lighter green lines), which means that the user-clustering jointly used with RCN coloring depends less on

the antennas' location pattern and can provide more stable link capacity.

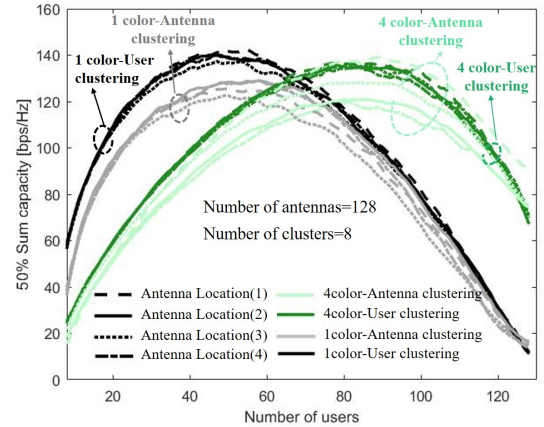


Fig. 2. Comparison of sum capacity for two clustering methods.

3. Conclusion

In this paper, we compared the two clustering methods jointly used with graph coloring algorithm. From the simulation results, we obtained the following conclusions:

1. The graph coloring algorithm is useful to improve the link capacity when the number of users is more than half of the number of antennas.
2. The user-based clustering method jointly used with graph coloring is less affected by the antennas' location pattern and can provide more stable link capacity than antenna-based clustering method.

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