

Joint BS-user Association, Power Allocation and User Side Interference Cancellation in Cell-free Heterogeneous Networks

Abstract:

Future wireless networks are expected to be heterogeneous with dense deployment of pico (small cell) base stations (BSs) overlaid with traditional macro BSs. There are two performance bottlenecks in such heterogeneous networks (HetNet): the interference issue and cell-edge effect. We propose to combine cell-free BS-user association (BUA), power control and dynamic user side interference cancellation (IC) to mitigate these bottlenecks. By dynamically selecting the “best” serving BSs for each user, the cell-free BUA can exploit the multi-BS diversity gain to mitigate the interference and cell-edge effect. Furthermore, the user side IC eliminates the strong cross-tier interference. We formulate the joint optimization of cell-free BUA, power allocation and user side IC as a weighted sumrate (WSR) maximization problem, and propose a WMMSE alternating optimization algorithm to solve it. Specifically, a generalized WMMSE method is proposed to solve the power optimization subproblem with non-differentiable WSR function. Furthermore, by exploiting the specific problem structure, low complexity search methods are designed to find the optimal solutions of the combinatorial cell-free BUA and user-side IC subproblems. The proposed algorithm is shown to converge to a stationary solution of the joint problem. Simulations verify the significant gain of the proposed solution over existing solutions.