Distributed Linear Precoder Optimization and Base Station Selection for an Uplink Heterogeneous Network

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In a heterogeneous wireless cellular network, each user may be covered by multiple access points such as macro/pico/relay/femto base stations (BS). An effective approach to maximize the sum utility (e.g., system throughput) in such a network is to jointly optimize users' linear procoders as well as their base station associations. In this paper we first show that this joint optimization problem is NP-hard and thus is difficult to solve to global optimality. To find a locally optimal solution, we formulate the problem as a noncooperative game in which the users and the BSs both act as players. We introduce a set of new utility functions for the players and show that every Nash equilibrium (NE) of the resulting game is a stationary solution of the original sum utility maximization problem. Moreover, we develop a best-response type algorithm that allows the players to distributedly reach a NE of the game. Simulation results show that the proposed distributed algorithm can effectively relieve local BS congestion and simultaneously achieve high throughput and load balancing in a heterogeneous network.

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