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# Cooperative Spectrum Sharing Between Cellular and Ad-Hoc Networks

## Abstract:

Spectrum sharing between cellular and ad-hoc networks is studied in this work. Weak signals and strong interferences at the cell-edge area usually cause severe performance degradation. To improve the cell-edge users' performance quality while keeping high spectrum efficiency, in this paper, we propose a cooperative spectrum sharing scheme. In the proposed scheme, the ad-hoc users can actively employ cooperative diversity techniques to improve the cellular network downlink throughput. As a reward, a fraction of the cellular network spectrum is released to the ad-hoc network for its own data transmission. To determine the optimal spectrum allocation, we maximize the ad-hoc transmission capacity subject to the constraints on the outage probability of the ad-hoc network and on the throughput improvement ratio of the cellular network. Both the transmission capacity of the ad-hoc network and the average throughput of the cellular network are analyzed using the stochastic geometry theory. Numerical and simulation results are provided to validate our analytical results. They demonstrate that our proposed scheme can effectively facilitate ad-hoc transmissions while moderately improving the cellular network performance.