Adaptive Weighted Sensing With Simultaneous Transmission for Dynamic Primary User Traffic

Abstract:

In practical scenarios with random arrival and departure of primary users (PUs), existing simultaneous sensing and transmission schemes allocated the same weight to each sample, and did not consider low signal-to-noise ratio (SNR) situations. This paper proposes an adaptive weighted sensing scheme with simultaneous transmission for dynamic PU traffic. It uses a power function based on the corresponding sampling sequence and could reveal the actual PU state in near real time. The power exponent is further adjusted to the sensing situations to achieve lowest false alarm probability under a certain detection probability constraint. Then, an analytical model considering all possible PU state transitions is developed to evaluate achievable interference, throughput, and energy efficiency. Furthermore, the optimal frame duration yielding both optimal false alarm probability and throughput is computed. After that, a fast search algorithm is proposed to track the optimal duration at an exponential convergence rate. Simulation results are provided to validate the analytical model and demonstrate the improvement in low SNR. The results indicate that the proposed scheme can achieve lower false alarm probability and higher energy efficiency over a wide SNR range than that of the existing weighting schemes, which are based on probability, geometric sequence, and equal weighting.