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Access Schemes for Mitigating the Effects of Sensing Errors in Cognitive Wireless Networks

Abstract:

We study from a cross-layer perspective a cognitive network consisting of one primary user (PU) and one secondary user (SU). In contrast with the oversimplified collision channel model, we assume that simultaneous PU and SU transmissions are successful with some positive probability. We propose and analyze two access schemes at the SU aiming at maximizing its stable throughput while guaranteeing the stability of the PU's queue. These schemes exploit the SU's knowledge of the channel statistics and of the average arrival rate to the PU. In the first scheme, the SU accesses the channel at all slots with fixed probability p^* without sensing. In the second scheme, the SU accesses the channel with probabilities p_1^* and p_2^* when the PU is sensed to be idle and busy, respectively. The analysis shows that if simultaneous PU and SU transmissions are likely to be successful, schemes with no sensing outperform schemes with sensing. Otherwise, schemes with sensing are preferred. Therefore, using complex receivers capable of handling interference, alleviates the need of complex SU transmitters with strong sensing capabilities. We then extend the analysis to the case where the PU has an average delay constraint which is more restrictive than the stability constraint.