Cooperative Sensing Scheduling Strategies for Cognitive Radio Networks

Abstract
In this thesis, our main focus is on cooperative sensing scheduling (CSS) for cognitive radio networks (CRNs). We first consider the joint scheduling of sensing and transmission for a multi-channel CRN with varying sensing accuracy among secondary users (SUs). We give the optimization model that maximizes the expected throughput together with our solution methodology. Then, we turn our attention to the trade-offs involved in providing energy efficiency (EE) in CRNs. We analyze how these trade-offs affect each other and energy consumption of CRNs. Furthermore, we also explore future research directions that are related to the EE of CRNs. After discussing the factors regarding EE, we focus on the EE of CSS for two cases. For the first case, we consider the energy consumption of CSS in terms of sensing and reporting energy components. For the second case, we also take the energy consumption due to channel switching into account. We provide the optimization models together with optimal solution methods for both cases. Our models support heterogeneous channel conditions which allows us to adjust the sensing durations based on the signal strength. Moreover, we also propose time efficient suboptimal heuristic methods. We observe that sacrificing little transmission time results in huge energy savings in the long run. Finally, we delve into the CSS problem in a social CRN setting where SUs cooperate probabilistically based on their social ties. In this scenario, we first formulate the cooperative detection and false alarm probabilities in addition to a simple trust mechanism. Subsequently, we give a multi-objective optimization model that maximizes expected throughput and accuracy of sensing results together. Numerical evaluations show that our method performs very close to the throughput optimal solution when there are no malicious SUs, and outperforms it in case of a misbehaving SU.

PUBLICATIONS
Journals

Book Chapters
Conferences

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