NOTICE

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**Statistical Interference Modeling and
Coexistence Strategies in Cognitive Wireless Networks**

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A copy of the doctoral dissertation is on reserve in the Johnson Center Library.

Statistical Interference Modeling and Coexistence Strategies in Cognitive Wireless Networks

Abstract

Cognitive radio is a novel approach for better utilization of the scarce, already packed but highly underutilized radio spectrum. To this end, environment-aware unlicensed secondary wireless devices are envisioned to share the spectrum with the primary licensed network, provided that their operation does not impose unmanageable interference on the primary nodes.

To achieve this coexistence goal, interference modeling is of great significance. Interference, in general, has a stochastic nature not only due to randomness in the propagation channel, but also due to the random geographic dispersion of nodes. A statistical representation for interference, in which the power levels of the secondary nodes influence the parameters of the model, is, thus, of considerable interest in analysis and design of cognitive wireless network.

Stochastic geometry and theory of spatial point processes are used for modeling the coexisting primary and secondary networks. In particular, we model these networks using spatial bivariate Poisson processes. We obtain statistical properties of the distances in these processes and use them for modeling the interference from secondary network on the primary nodes. We obtain two different models for the aggregate interference in which the power levels of secondary nodes can be adjusted to obtain desirable values for the parameters of the models.

Having this characterization of interference, we propose power control strategies for the secondary network which assure the satisfaction of interference constraint at the primary nodes. We show that these strategies are very easy to implement with little coordination requirement. Nodes either need to know where they are located in the sequence of nodes ordered according to their Euclidean distance to a primary node or need no location information, based on which strategy is being used.

Given that secondary nodes have imposed power control strategies to coexist with the primary nodes, we find the lower bound of (i.e. achievable) throughput for the secondary nodes. We use the statistical properties of distances between secondary nodes and find an upper bound for the interference of secondary network on an arbitrary secondary node and thereby a lower bound for its throughput. We show that the approach is applicable for finding the throughput in a general power-constrained random network.