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# Prescient Beamforming by Primary Transmitters in Interweave Cognitive Radio Networks with a Single Primary Receiver

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This work investigates a fundamentally novel interweave cognitive radio network where the primary transmitter takes a proactive approach towards improving the accuracy of the spectrum sensing outcomes at the secondary users (SUs). For the single-primary-receiver scenario considered here, the multi-antenna primary user constructs its transmit beamforming vector so as to increase the detection probability at the SUs while meeting a desired Quality-of-Service (QoS) target on its own link, by exploiting either partial or statistical channel state information of the SUs. The objective of such a proactive approach, which we refer to as prescient precoding, is to minimize the probability of interference from SUs at the primary receiver due to imperfect spectrum sensing in fading channels. We also develop information-theoretic bounds on the performance of prescient transmission and study non-linear precoding schemes that approach them. Numerical results are presented to verify the advantages of the proposed prescient transmission techniques for both non-cooperative and cooperative spectrum sensing scenarios.

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