IEEE Transactions on Cognitive Communications and Networking

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Manuscript Type	Transactions Paper Submissions
Title	Learning-based Spectrum Sensing in Cognitive Radio Networks via Approximate POMDPs
Abstract	In this paper, a novel spectrum sensing and access strategy is proposed, wherein a cognitive radio learns a time-frequency correlation model defining the occupancy behavior of incumbents via the Baum-Welch algorithm, and concurrently devises an optimal spectrum sensing and access strategy that exploits this learned correlation model, under spectrum sensing constraints. The optimal strategy is optimized via an approximate point-based value iteration method, to facilitate control of the trade-off between secondary network throughput and incumbent interference, along with fragmentation and Hamming distance state filters to alleviate its computational complexity. Numerical results demonstrate improvements over state-of-the-art algorithms: 60% over correlation-based clustering, 25% over Neyman-Pearson Detection, 6% over Viterbi, and 7% over adaptive deep Q-network. The proposed solution is extended to a distributed multi-agent setting with neighbor discovery and channel access rank allocation, which improves throughput by 43% over cooperative Temporal Difference SARSA, 84% over cooperative greedy distributed learning, and 3x over non-cooperative learning via g-statistics and ACKs. This multi-agent scheme is implemented on the DARPA Spectrum Collaboration Challenge (SC2) platform, demonstrating superior performance over competitors in a real-world TDWR-UNII WLAN scenario emulation, and its implementation feasibility is demonstrated on an ad-hoc distributed wireless platform of ESP32 radios, exhibiting 96% success probability. Less text

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File 2	Learning_based_Spectrum_Sensing_in_CRNs_via_Approx_POMDPs_SC.pdf

✔ Step 3: Attributes

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FIELD	RESPONSE
Keyword	• Hidden Markov models • Cognitive radio ad hoc networks • Consensus-based cooperative spectrum sensing • Markov processes

✔ Step 4: Authors & Institutions Edit

FIELD	RESPONSE
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Cover Letter	
Funding	National Science Foundation CNS-1642982

Manuscript Information

* Number of Figures: 8

* Number of Color Figures: 8

* Number of Tables: 0

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