

IEEE Signal Processing Society Syracuse Chapter
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Dynamic Spectrum Access with Learning for Cognitive Radio

We study the problem of dynamic spectrum sensing and access in cognitive radio systems as a partially observed Markov decision process (POMDP). A group of cognitive users cooperatively tries to exploit vacancies in some primary (licensed) channels whose occupancies have a Markovian evolution. We first consider the scenario where the cognitive users are aware of the distribution of the signals they receive from the primary users and they use their observations to track the occupancies of the various primary channels that are being monitored. For this problem, we obtain a greedy channel selection and access policy that maximizes the instantaneous reward, while satisfying a constraint on the probability of interfering with licensed transmissions. Through simulation, we show that this policy achieves substantial performance improvement relative to existing schemes. We also derive an analytical universal upper bound on the performance of the optimal policy with which we compare the performance of our scheme to further demonstrate its efficiency.

We then consider the more practical scenario where the exact distribution of the signal from the primary is unknown. We assume that the distribution can be characterized by a random parameter and develop an algorithm that can learn this random parameter, still guaranteeing the constraint on the interference probability. We show that this algorithm out-performs the naive design that assumes a worst-case value for the parameter. We also provide a proof for the convergence of the learning algorithm. (This is joint work with Jay Unnikrishnan.)

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Biography: Prof. Veeravalli received the Ph.D. degree from the University of Illinois at Urbana-Champaign in 1992, the M.S. degree from Carnegie-Mellon in 1987, and the B.Tech degree (with Silver Medal honors) from IIT Bombay in 1985. He was on the faculty of the School of ECE at Cornell University before he joined Illinois in 2000. He served as a program director for communications research at the U.S. National Science Foundation in Arlington, VA during 2003-2005. His research interests include wireless communications, distributed sensor systems and networks, detection and estimation theory, and information theory. He is a Fellow of the IEEE, and a recipient of the IEEE Browder J. Thompson Best Paper Award and the Presidential Early Career Award for Scientists and Engineers (PECASE).

Please contact Brenda Flowers (bflowers@syr.edu) for direction and parking information.