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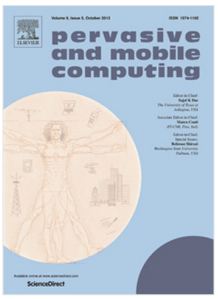

Outage and energy-efficiency analysis of cognitive radio networks: A stochastic approach to transmit antenna selection

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PII: S1574-1192(16)30302-9
DOI: http://dx.doi.org/10.1016/j.pmcj.2017.05.008
Reference: PMCJ 840

To appear in: *Pervasive and Mobile Computing*

Please cite this article as: S. Sabuj, M. Hamamura, Outage and energy-efficiency analysis of cognitive radio networks: A stochastic approach to transmit antenna selection, *Pervasive and Mobile Computing* (2017), http://dx.doi.org/10.1016/j.pmcj.2017.05.008

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Outage and Energy-Efficiency Analysis of Cognitive Radio Networks: A Stochastic Approach to Transmit Antenna Selection

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Abstract

Cognitive radio networks have recently attracted significant research attention owing to their promise for application in future cellular communication. In this light, given the intense power consumption of wireless networks, considerable research is now being directed at designing random cognitive radio networks with enhanced energy efficiency. In this study, we investigate the outage probability and energy efficiency in a cognitive radio network, modeling the locations of the primary users and cognitive users as a Poisson point process. We derive closed-form expressions for the outage probability and energy efficiency with consideration of the *probabilities of unoccupied* (not utilized by the primary users) *channel selection* and *successful transmission* for imperfect detection in an interference-limited environment of cognitive radio network. Furthermore, we propose a transmit antenna selection method for the cognitive transmitter in such networks and accordingly develop closed-form expressions for the outage probability and energy efficiency. The study reported here highlights the importance of combining the capabilities of *unoccupied channel selection* and *successful transmission* in cognitive radio networks to achieve optimal performance regarding outage probability and energy efficiency. In terms of energy efficiency, there is an optimal threshold that maximizes the energy efficiency. For implementation in transmit antenna selection, the outage probability can be significantly decreased by increasing the number of transmit antennas, even though the energy efficiency is maximized at the target outage probability.

Keywords: Cognitive radio network; Stochastic geometry; Poisson point process; Energy efficiency.

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