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Improved two-stage spectrum sensing for cognitive radio networks

Abu-Mahfouz, Adnan MI
Council for Scientific and Industrial Research
Pretoria, 0001, South Africa
Email: AAbuMahfouz@csir.co.za

Abstract

Cognitive radio employs an opportunistic spectrum access approach to ensure efficient utilization of the available spectrum by secondary users (SUs). To allow SUs to access the spectrum opportunistically, the spectrum sensing process must be fast and accurate to avoid possible interference with the primary users. Previously, two-stage spectrum sensing methods were proposed that consider the sensing time and sensing accuracy parameters independently at the cost of a non-optimal spectrum sensing performance. To resolve this non-optimality issue, we consider both parameters in the design of our spectrum sensing scheme. In our scheme, we first derive optimal thresholds using an optimization equation with an objective function of maximizing the probability of detection, subject to the minimal probability of error. We then minimize the average spectrum sensing time using signal-to-noise ratio estimation. Our simulation results show that the proposed improved two-stage spectrum sensing (ITSS) scheme provides a 4%, 7%, and 6% better probability of detection accuracy rate than two-stage combinations of energy detection (ED) and maximum eigenvalue detection, energy detection and cyclostationary feature detection (CFD), and ED and combination of maximum-minimum eigenvalue (CMME) detection, respectively. The ITSS is superior also to single-stage ED by 19% and shows an improved average spectrum sensing time.