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A cuckoo search optimization-based forward consecutive mean excision model for threshold adaptation in cognitive radio.

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ABSTRACT:

The forward consecutive mean excision (FCME) algorithm is one of the most effective adaptive threshold estimation algorithms presently deployed for threshold adaptation in cognitive radio (CR) systems. However, its effectiveness is often limited by the manual parameter tuning process and by the lack of prior knowledge pertaining to the actual noise distribution considered during the parameter modeling process of the algorithm. In this paper, we propose a new model that can automatically and accurately tune the parameters of the FCME algorithm based on a novel integration with the cuckoo search optimization (CSO) algorithm. Our model uses the between-class variance function of the Otsu's algorithm as the objective function in the CSO algorithm in order to auto-tune the parameters of the FCME algorithm. We compared and selected the CSO algorithm based on its relatively better timing and accuracy performance compared to some other notable metaheuristics such as the particle swarm optimization, artificial bee colony (ABC), genetic algorithm, and the differential evolution (DE) algorithms. Following close performance values, our findings suggest that both the DE and ABC algorithms can be adopted as favorable substitutes for the CSO algorithm in our model. Further simulation results show that our model achieves reasonably lower probability of false alarm and higher probability of detection as compared to the baseline FCME algorithm under different noise-only and signal-plus-noise conditions. In addition, we compared our model with some other known autonomous methods with results demonstrating improved performance. Thus, based on our new model, users are relieved from the cumbersome process involved in manually tuning the parameters of the FCME algorithm; instead, this can be done accurately and automatically for the user by our model. Essentially, our model presents a fully blind signal detection system for use in CR and a generic platform deployable to convert other parameterized adaptive threshold algorithms into fully autonomous algorithms.