Forward M-ary Hypothesis Testing Based Detection Approach for Passive Radar

Abstract:

In contrast to active radar systems, in which the transmitted waveforms are carefully selected and designed in relation to the radar operational modes and requirements, passive radars(PRs) exploiting non-cooperative illuminators of opportunity need to cope with waveforms that are not tailored for the radar applications. In the latter case, it is likely that target echoes are masked by echoes from other strong targets in multi-target scenarios. This fact inspired us to model the multitarget detection problem in the PRs as an M-ary hypothesis testing problem. We then employ the generalized likelihood ratio (GLR) principle to derive the GLR-based detector. A parallel and recursive implementation of the detector is presented for computationally efficient implementation, in which the targets are detected sequentially and the previously detected targets are treated as interferences to be removed yielding the detection of the weakest ones. The false alarm and detection performance of the proposed sequential GLR-based detector are analytically studied using asymptotic distribution and also their accuracies are verified numerically. Simulation results show that there is a high agreement between asymptotic performance and the one obtained by simulation results. Extensive simulation results for both FM and DVB-T based passive radars are presented to demonstrate the effectiveness of the proposed detection algorithm. Furthermore, it can be revealed from our simulation results that the proposed

detection algorithm significantly outperforms the existing methods without adding significant complexity to them.