Power-Constrained Secrecy Rate Maximization for Joint Relay and Jammer Selection Assisted Wireless Networks

Abstract:

In this paper, we examine the physical layer security for cooperative wireless networks with multiple intermediate nodes, where the decode-and-forward protocol is considered. We propose a new joint relay and jammer selection (JRJS) scheme for protecting wireless communications against eavesdropping, where an intermediate node is selected as the relay for the sake of forwarding the source signal to the destination and meanwhile, the remaining intermediate nodes are employed to act as friendly jammers, which broadcast the artificial noise for disturbing the eavesdropper. We further investigate the power allocation among the source, relay and friendly jammers for maximizing the secrecy rate of proposed JRJS scheme, and derive a closed-form sub-optimal solution. Specifically, all the intermediate nodes, which successfully decode the source signal, are considered as relay candidates. For each candidate, we derive the sub-optimal closed-form power allocation solution and obtain the secrecy rate result of the corresponding JRJS scheme. Then, the candidate, which is capable of achieving the highest secrecy rate, is selected as the relay. Two assumptions about the channel state information (CSI), namely the full CSI (FCSI) and partial CSI (PCSI), are considered. Simulation results show that the proposed JRJS scheme outperforms the conventional pure relay selection, pure jamming, and generalized singular-value-decomposition-based beamforming schemes in terms of secrecy rate. Additionally, the proposed FCSI-based power allocation and PCSI-based power allocation schemes both achieve higher secrecy rates than the equal power allocation scheme.