Application of Bat Algorithm and Its Modified Form Trained with ANN in Channel Equalization

ABSTRACT

The transmission of high-speed data over communication channels is the function of digital communication systems. Due to linear and nonlinear distortions, data transmitted through this process is distorted. In a communication system, the channel is the medium through which signals are transmitted. The useful signal received at the receiver becomes corrupted because it is associated with noise, ISI, CCI, etc. The equalizers function at the front end of the receiver to eliminate these factors, and they are designed to make them work efficiently with proper network topology and parameters. In the case of highly dispersive and nonlinear channels, it is well known that neural network-based equalizers are more effective than linear equalizers, which use finite impulse response filters. An alternative approach to training neural network-based equalizers is to use metaheuristic algorithms. Here, in this work, to develop the symmetry-based efficient channel equalization in wireless communication, this paper proposes a modified form of bat algorithm trained with ANN for channel equalization. It adopts a population-based and local search algorithm to exploit the advantages of bats' echolocation. The foremost initiative is to boost the flexibility of both the variants of the proposed algorithm and the utilization of proper weight, topology, and the transfer function of ANN in channel equalization. To evaluate the equalizer's performance, MSE and BER can be calculated by considering popular nonlinear channels and adding nonlinearities. Experimental and statistical analyses show that, in comparison with the bat as well as variants of the bat and state-of-the-art algorithms, the proposed algorithm substantially outperforms them significantly, based on MSE and BER.