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SATELLITE FREQUENCY-HOPPING COMMUNICATION SYNCHRONIZATION ALGORITHM BASED ON INTERFERENCE COGNITION AND MATCHED FILTERING

Abstract

Signal synchronization is a prerequisite for the normal operation of a receiver in satellite frequency hopping communication. If synchronization is abnormal, it will seriously affect the ability of information exchange. Currently, sliding correlation is a commonly used synchronization algorithm due to its simple implementation. However, when the phase difference between the received signal and the local synchronization header is large, there will be a problem of long capture time. To solve this problem, this paper adopts matched filtering as a synchronization method. By changing the serial sliding correlator to parallel form, the capture time is greatly reduced. In addition, with the emergence of various electromagnetic interference methods, how to overcome the interference environment and ensure satellite signal synchronization has become an urgent problem to be solved. Therefore, interference cognition technology is introduced into the satellite communication synchronization process in this paper. Based on interference recognition, appropriate anti-interference measures are taken to suppress interference and achieve the purpose of ensuring satellite signal synchronization. Considering the limited storage space and computing resources of portable satellite receivers, a low-complexity recognition algorithm needs to be designed. Therefore, based on the ideas of asymmetric convolution and grouped convolution, a lightweight asymmetric convolution residual neural network is proposed in this paper, and the time-frequency map of the signal is used as input for interference recognition. The network uses asymmetric convolution kernels, which can extract multi-scale feature information using asymmetric convolution. While ensuring recognition accuracy, the number of network parameters is reduced, thereby reducing the computational load. Then, to solve the problem of low accuracy in single-node interference recognition, the idea of multi-node collaboration is adopted in this paper to improve the accuracy of interference recognition by fusing multi-node interference recognition information. Finally, corresponding interference suppression measures are formulated based on the type of interference signal to achieve the purpose of ensuring satellite frequency hopping signal synchronization. Experiments show that the synchronization algorithm designed in this paper has the advantages of fast synchronization speed and strong anti-interference ability.