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MODULATION RECOGNITION BASED ON CONVOLUTION NEURAL NETWORK AND FUSION
TIME-FREQUENCY FEATURES

Abstract

In the operational responsive space mission, the operational responsive space satellite (ORS Sat) must know which satellite can be used as the relay satellite to transmit information. Relay communication needs automatic classification of satellite modulation, so modulation identification plays an important role in heterogeneous satellite network, especially in ORS. Modulation recognition is helpful to identify users and distinguish sources of interference, and increase situational awareness. In order to improve the recognition accuracy in the case of low Signal Noise Ratio (SNR) and frequency offset, a new recognition method based on fusion time-frequency features and convolutional neural network is proposed. A new time-frequency transform combining short-time Fourier transform (STFT) and Wigner-Ville distribution (WVD) was proposed aiming at the problem of mutual restriction between time-frequency focusing and cross term suppression of single time-frequency transform. The new fusion time-frequency features combine the characteristics of STFT without cross term and WVD with high time-frequency resolution. In this paper, first, STFT and WVD are used to transform the sampled satellite communication signal respectively, then STFT is truncated to remove the noise energy, and finally, the time-frequency characteristics of satellite signals is represented by Hadamard transform of STFT and WVD. Taking time-frequency image as recognition feature provides a new method for satellite communication signal recognition. By learning the time-frequency characteristics of satellite signal, the modulation recognition problem is transformed into image recognition problem. Convolutional neural networks (CNNs) show excellent performance in image classification and image recognition. In this paper, CNN is used as classifier to complete modulation recognition of satellite communication signal. The simulation results show that compared with single time-frequency transform, the new combined time-frequency transform features and CNN show better performance in modulation recognition of satellite relay communication.