Radar Signals Modulation Recognition Based on Bispectrum Feature Processing

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Abstract

Modulation recognition of radar signals is an important part of modern electronic intelligence reconnaissance and electronic support systems. In this paper, to solve the problem of low recognition accuracy and low noise resistance of radar signals under low signal-to-noise ratio(SNR), a recognition method based on variational mode decomposition(VMD) and bispectrum feature extraction is proposed. Based on the feature that bispectrum can suppress Gaussian noise, the feasibility of signals modulation recognition under low SNR is analyzed and the noise item is introduced. Due to the interference of noise item, the noise suppression effect of bispectrum is worse under 0dB. An improved VMD algorithm based on artificial bee colony(ABC) algorithm optimization and envelope entropy evaluation is proposed to preprocess the signal to improve the SNR. Finally, we designed a convolution neural network(CNN) classifier to recognize signals of different modulation types. The simulation results show that this method has better noise resistance than traditional methods, and can effectively identify different types of signals under low SNR.

Full Text

This preprint is available for download as a PDF.

Figures

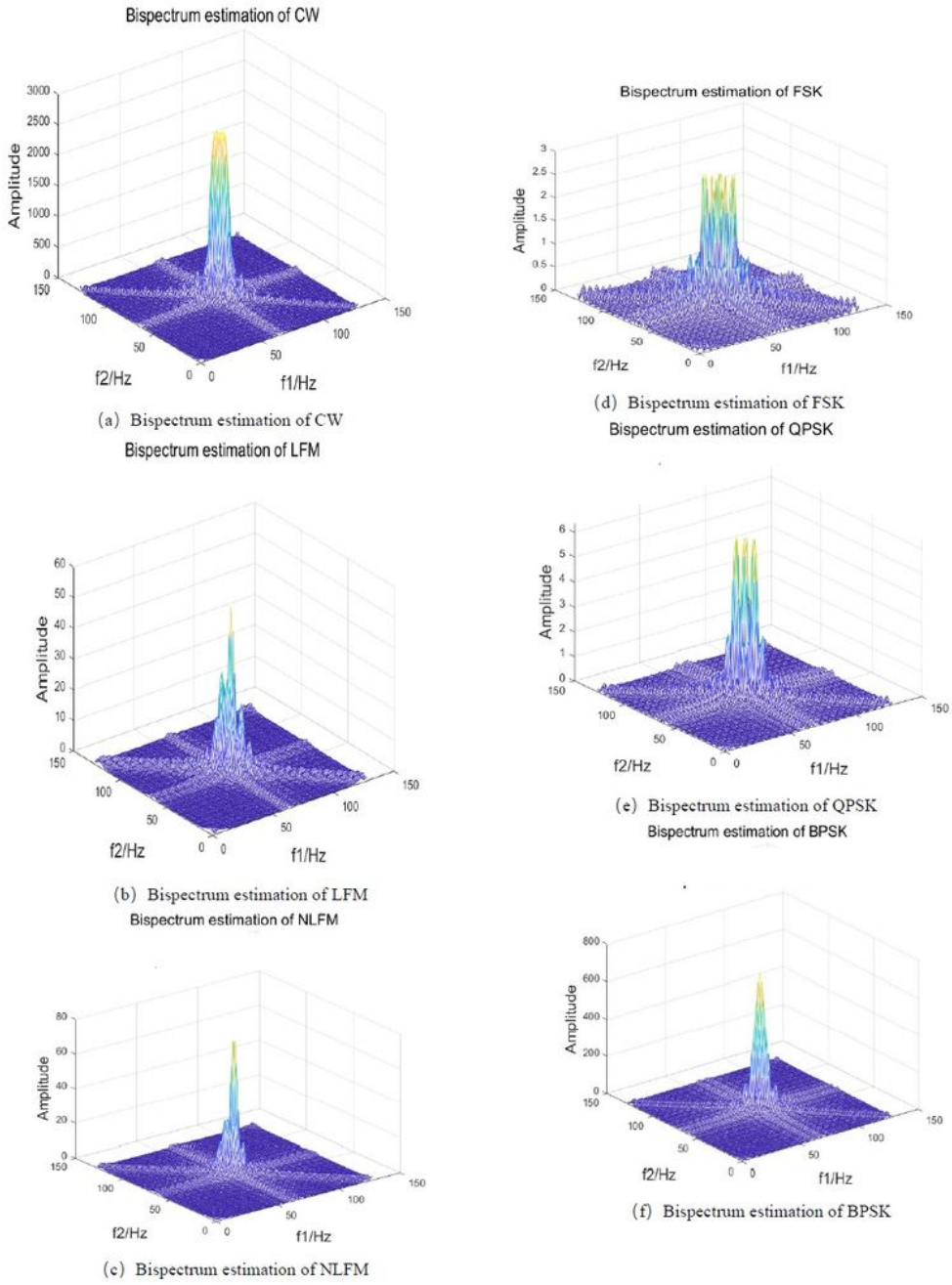

Figure 1

Estimated bispectrums of four radar signals with Gaussian noises

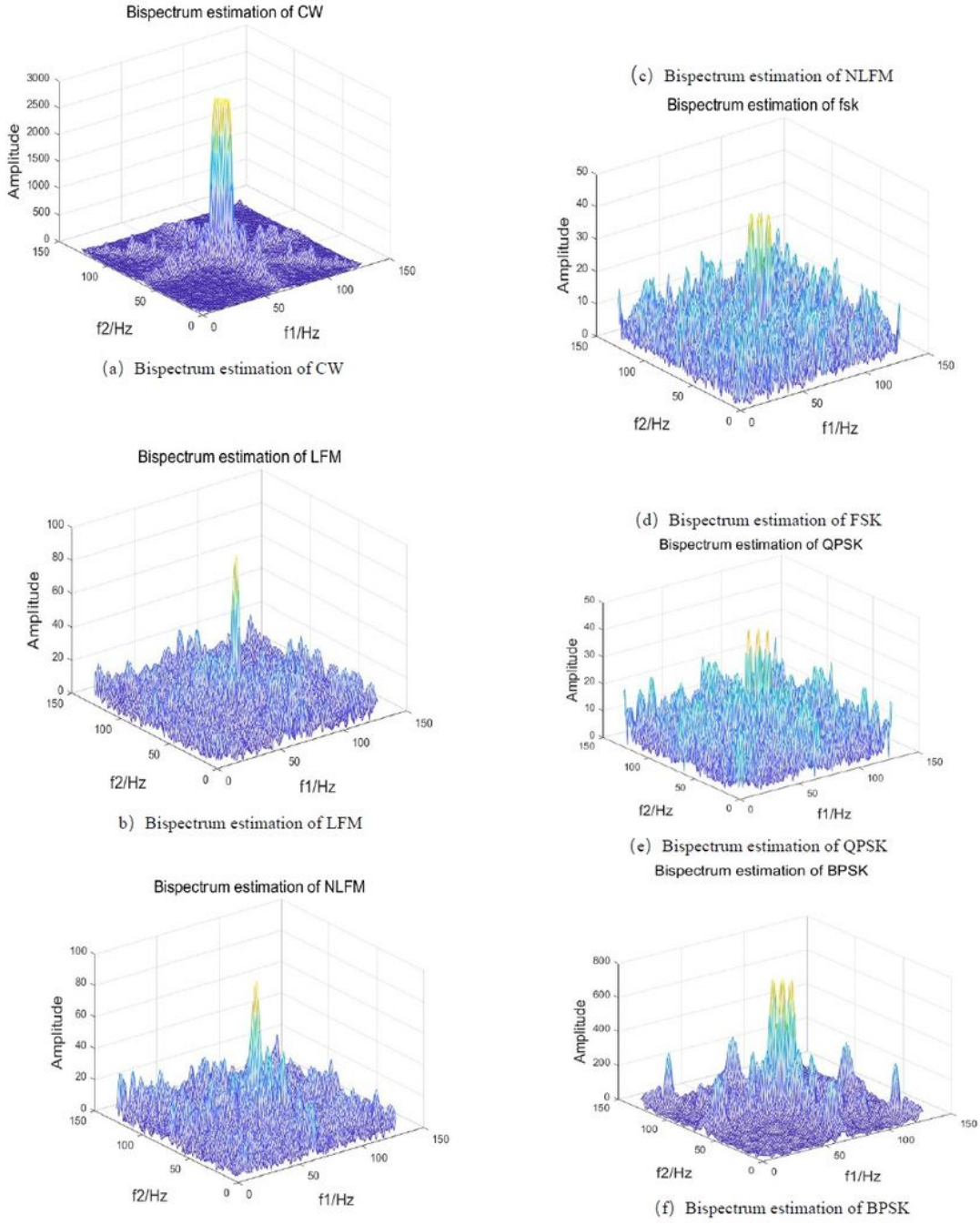

Figure 2

Bispectrum of various signals with noise of - 5dB

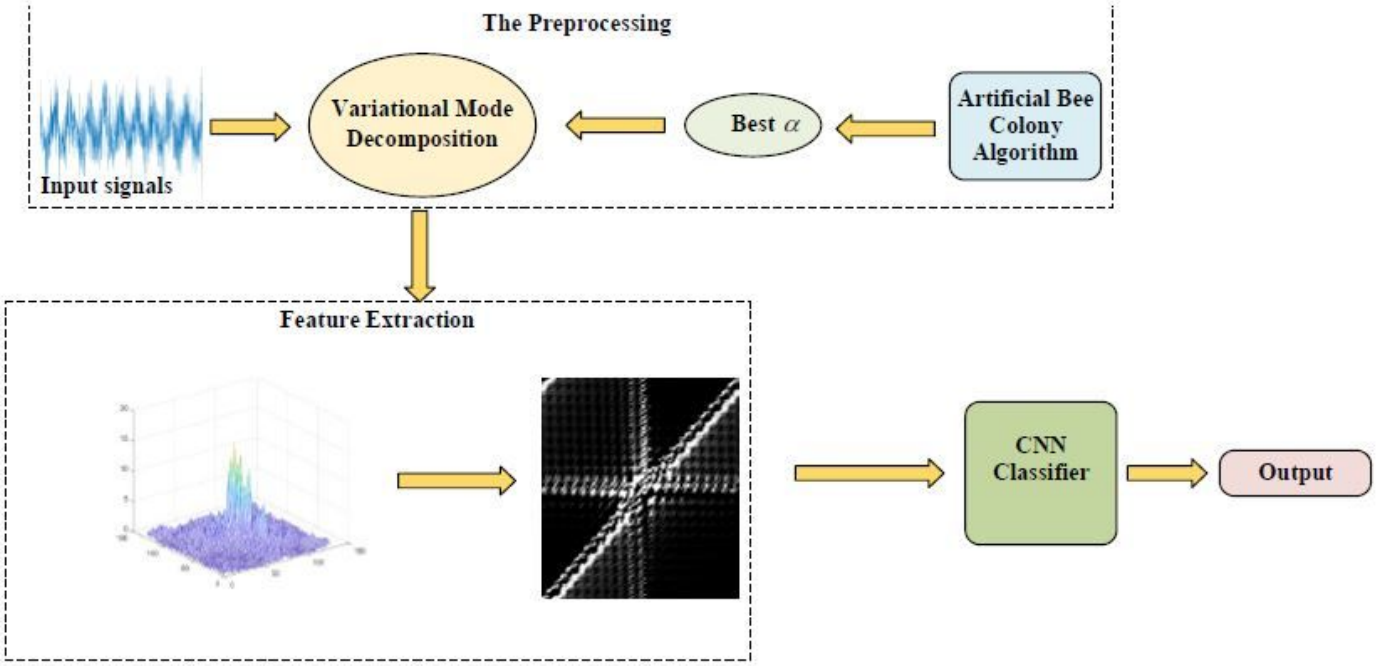

Figure 3

The propose d system Structure

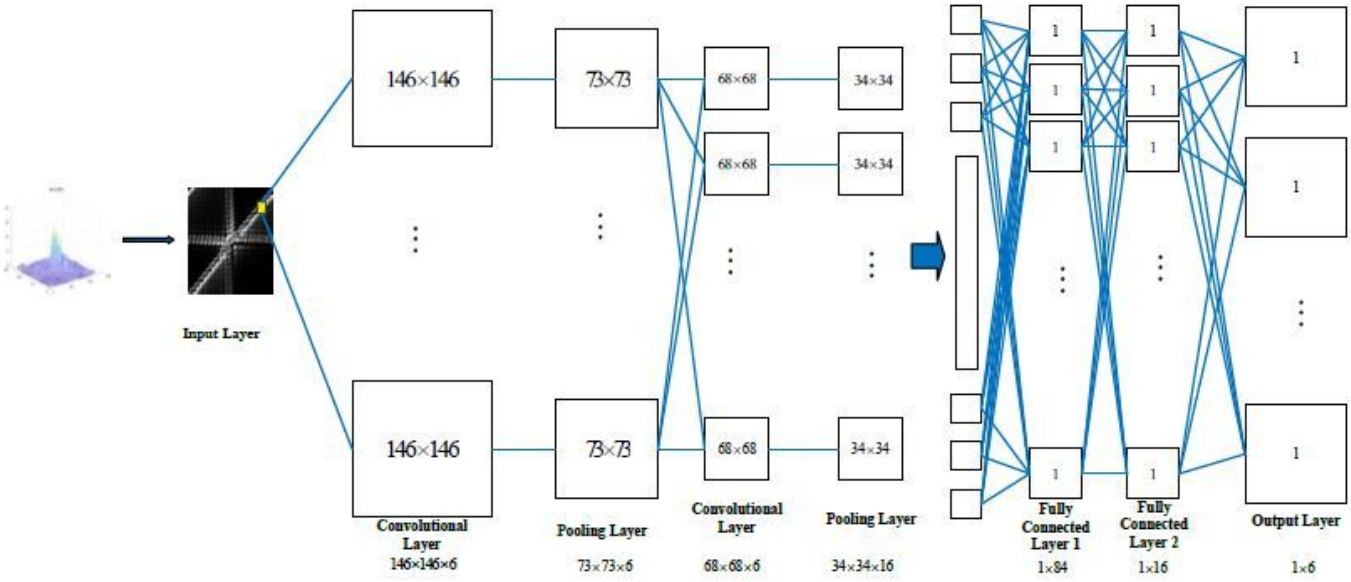

Figure 4

The network structure of classifier based on convolutional neural network

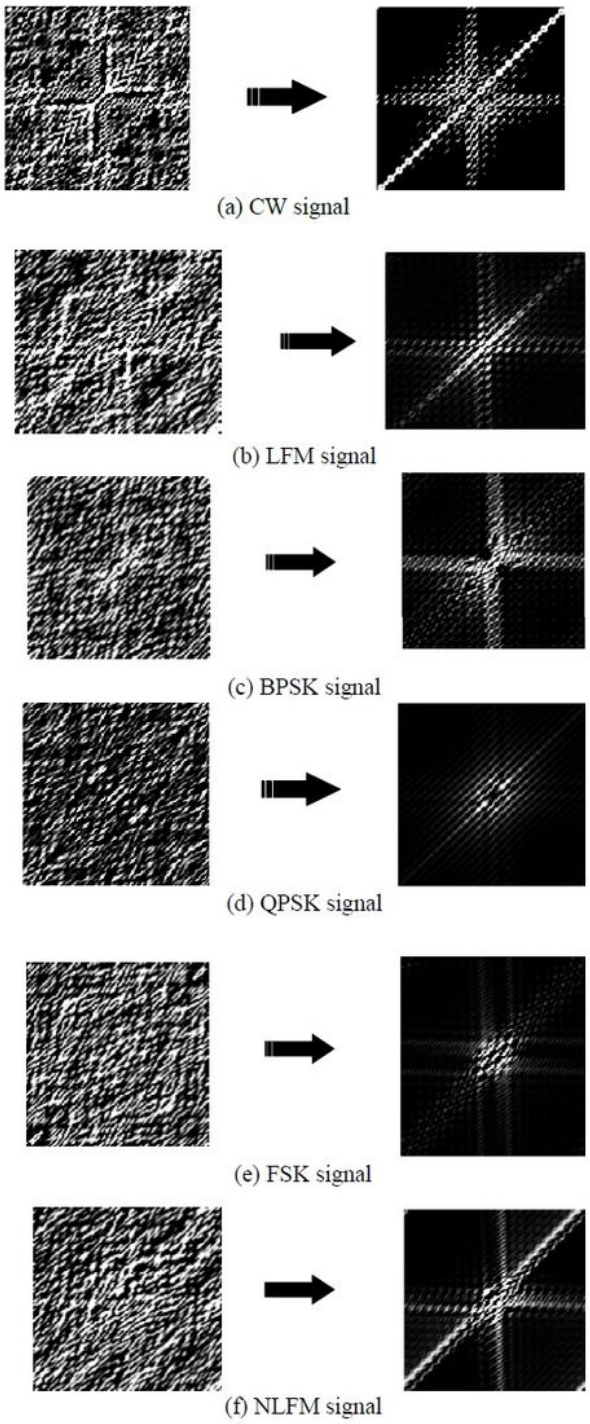

Figure 5

Bispectrum after signal preprocessing under noise of - 5dB

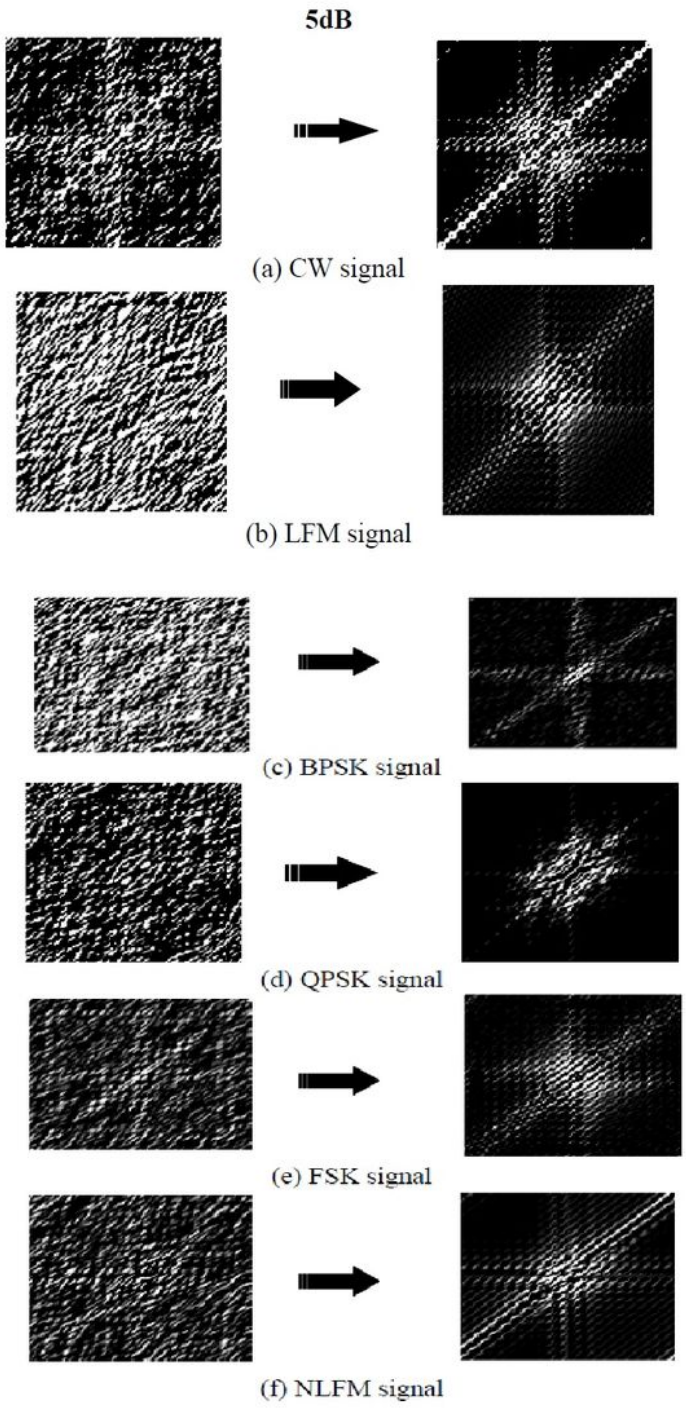

Figure 6

Bispectrum after signal preprocessing under noise of - 5dB

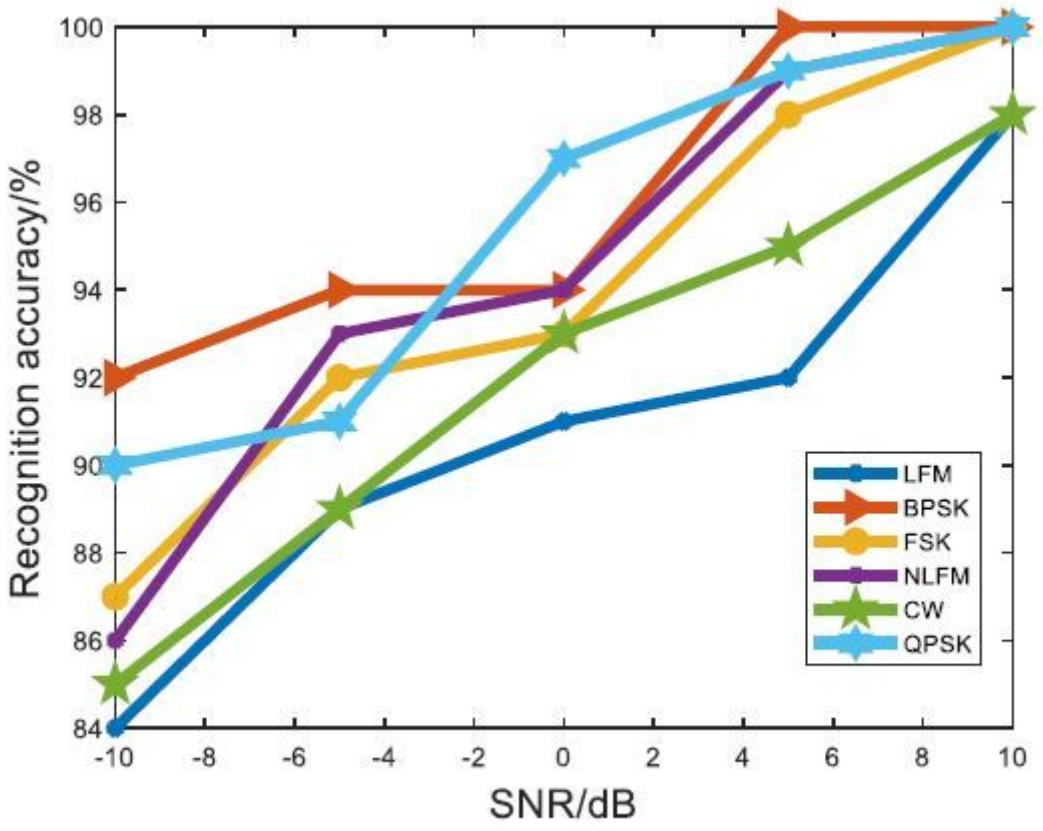

Figure 7

Recognition rate of various signals under different SNR

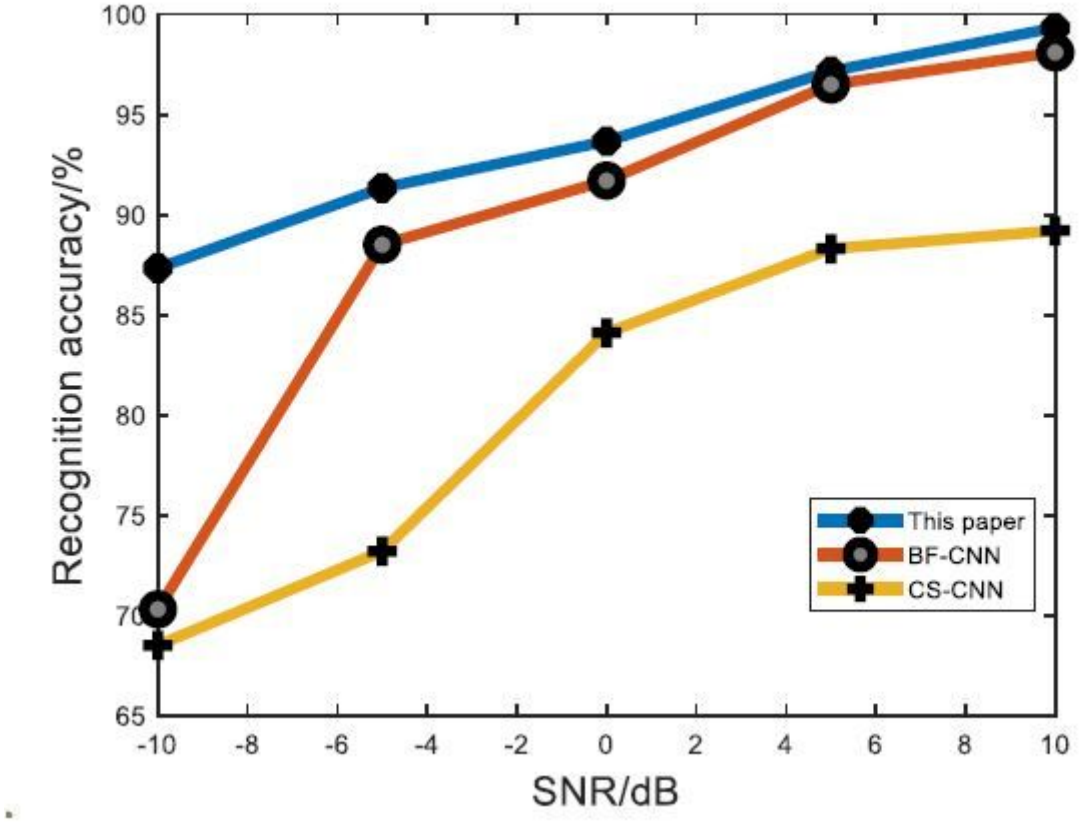

Figure 8

Comparison of recognition rates of different methods