

Table 1. Output signal-to-noise ratios at different input signal-to-noise ratios/dB

Input SNR/dB	Speech enhancement by Wavelet transform	Speech enhancement by Xia's method	Speech enhancement by the proposed algorithm
input SNR=-5	-0.3027	-0.1937	-0.0415
input SNR=-3	0.4272	0.8428	1.8821
input SNR=-1	0.9125	2.1086	3.1126
input SNR=0	2.0125	2.9479	3.7542
input SNR=1	3.8023	4.1038	4.8977
input SNR=3	4.9642	5.2980	6.2788
input SNR=5	6.2935	7.1458	7.5293

It can be seen from Table 1 that when the input SNR is increasing, the output signal-to-noise ratios of these algorithms are also increasing. However, when the input SNR is the same data, the output SNR of the speech signal by the algorithm is higher than the other two methods. Therefore, the speech enhancement algorithm proposed in this paper is better than the other methods.

4. CONCLUSION

In recent years, the Hilbert-Huang transform has been used in the nonlinear non-stationary signal processing widely. And has been applied in speech signal processing gradually. Due to its own shortcomings in EMD theory, HHT still has some shortcomings in signal processing. For example, EMD produces some false frequency components in the low frequency band; so far, the EMD decomposition theory cannot be well explained, so the components can only be decomposed sequentially from high to low frequency, and there is no way to factor out one or some of them directly; and processing cannot be carried out in real time, slowing down the speed of the algorithm. In addition, as the algorithm proposed in this paper cannot completely remove the background noise, it needs to be combined with other methods in order to further remove the noise. Despite these problems, Hilbert-Huang transform, as a new signal analysis method, has a broad application prospect. The simulation results show that the proposed algorithm can remove most of the noise in the speech signal. Compared with the wavelet transform speech enhancement algorithm and the Xia's method, the proposed algorithm increased the signal-to-noise ratio of speech signals and improved the quality of the speech signal.

ACKNOWLEDGMENT

This work is supported by Natural Science Foundation of Gansu Province (Grant No.: 17JR5RA101), and Gansu "13th Five-Year" Planned Education Science Research Topic (Grant No.: GS[2016]GHB0217).

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