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Improved Embedded Pre-whitening Subspace Approach for Enhancing Speech Contaminated by Colored Noise

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Abstract

An improved embedded pre-whitening subspace approach based on spectral domain constraints is proposed for enhancement of speech contaminated by colored noise. The main contribution of this work is to propose a particular non-unitary spectral transformation of the residual noise. This non-unitary transform is based on simultaneous diagonalization of the clean speech and noise covariance matrices. With this particular transformation, the optimization problem results from subspace approach based on spectral domain constraints can be solved without any restrictions on the form of contributed matrices. Under some theoretical assumptions the proposed method is reduced to the Hu and Loizou method, which is similar to the proposed method except for the gain matrix. Comparing with the Hu and Loizou method, speech enhancement measures for our approach show significant improvement in enhancing the TIMIT sentences corrupted by brown, pink and multi-talker babble noises. Also, comparisons with two non embedded pre-whitening subspace methods, PKLT and PKLT-VRE, show that the proposed method is comparable with these two methods.

Keywords: Speech enhancement, Subspace method, Colored noise

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