

算法研究

基于两步噪声消除技术与高斯统计模型的语音增强算法

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摘要:

针对语音增强技术中先验信噪比参数的估计问题, 本文通过结合两步噪声消除技术以及语音与噪声分量的高斯统计模型, 在频率域中提出了一种新的先验信噪比估计算法。该算法基于直接判决方法的输出结果, 利用最小均方误差估计理论直接计算当前帧纯净语音分量的谱能量, 以获取带噪语音的先验信噪比估计。算法在保留两步噪声消除算法优点的基础上, 无需语音增强系统中增益因子的任何先验条件, 且在有效消除背景噪声的同时能够最大程度地抑制输出语音中音乐噪声的生成。多种噪声背景下的仿真结果表明: 相对于经典的直接判决方法和新近的两步噪声消除算法, 基于本文先验信噪比估计方案的语音增强系统在主观与客观评价标准下都具有更加优良的语音增强效果。

关键词: 语音增强; 先验信噪比; 高斯统计模型; 最小均方误差; 噪声抑制

Speech Enhancement Based on Two-Step Noise Reduction and Gaussian Statistical Model

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Abstract:

In view of the estimation problem of a priori signal to noise ratio parameter in noisy speech enhancement, by combining two step noise reduction technique and the Gaussian statistical model, a novel estimation algorithm for a priori signal to noise ratio was proposed in frequency domain. Based on the estimation theory of minimum mean square error, the presented algorithm computes directly the square of the clean speech component in its second step to refine the estimated a priori signal to noise ratio of the decision directed approach, and thus the drawback of the two step noise reduction method whose performance is restricted on the gain function is removed. Moreover, the proposed algorithm has good performance in highly reducing the music noise of the output speech while the advantages in noise suppression are kept. Experimental results under different kinds of noisy conditions demonstrate that the performance of the proposed method outperforms that of the classic decision directed method and the recently proposed two step noise reduction technique in both objective and subjective tests.

Keywords: speech enhancement a priori signal to noise ratio Gaussian statistical model minimum mean square error; noise suppression

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