R20: A SOFT MASKING STRATEGY FOR SIMULTANEOUS SUPPRESSION OF NOISE AND REVERBERATION IN COCHLEAR IMPLANTS

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Although most cochlear implant (CI) users identify words and sentences with high accuracy in quiet and anechoic environments, their ability to recognize words degrades significantly in the presence of reverberation or/and noise. Reverberation and noise mask the speech in a rather complementary fashion. Hence, it is not surprising that the combined effects of reverberation and noise are more detrimental to speech intelligibility than that of either reverberation or noise-alone. The adverse impact of noise or reverberation on speech quality and intelligibility can be partially mitigated in the absence of the other. However, the suppression of both reverberation and noise in noisy reverberant environments is a challenging task, as the noise is added to the convolutive distortion caused by reverberation.

There exist practical algorithms for noise or reverberation suppression in CIs. Nevertheless, algorithms capable of tackling both reverberation and noise are more complicated and have not yet been investigated in the context of speech intelligibility improvements for CI users.

In the present study, we investigate a blind single-channel soft masking strategy to simultaneously suppress the negative effects of both reverberation and noise on speech identification performance of CI users. In this strategy, noise power spectrum is estimated from the non-speech segments of the utterance while reverberation power spectrum is computed as a delayed and scaled version of the reverberant speech spectrum. Based on the estimated noise and reverberation power spectra, a weight between 0 and 1 is assigned to each time-frequency (T-F) unit to form the final mask.

To evaluate the proposed speech enhancement strategy, intelligibility listening tests have been conducted with CI users for two reverberation times (T60 = 0.6 s and 0.8 s), wherein most of the existing dereverberation techniques fail to improve intelligibility, at a signal-to-noise ratio (SNR) of 15 dB (speech-shaped noise). A PDA research platform was employed to present the stimuli to CI subjects. In the implementation of the algorithm, the same parameters (frame size, frame shift, etc.) as the ones used in the ACE strategy are utilized. Obtained results indicate substantial improvements in speech intelligibility in both reverberant-alone and noisy reverberant conditions considered.

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