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Multi-Channel Post-Filtering in Non-Stationary Noise Environments

Israel Cohen

ABSTRACT

In this paper, we present a multi-channel post-filtering approach for minimizing the log-spectral amplitude distortion in non-stationary noise environments. The beamformer is realistically assumed to have a steering error, a blocking matrix that is unable to block all of the desired signal components, and a noise canceller that is adapted to the pseudo-stationary noise, but not modified during transient interferences. A mild assumption is made, that a desired signal component is stronger at the beamformer output than at any reference noise signal, and a noise component is strongest at one of the reference signals. The ratio between the transient power at the beamformer output and the transient power at the reference noise signals is used for indicating whether such a transient is desired or interfering. Based on a Gaussian statistical model and combined with an appropriate spectral enhancement technique, we derive estimators for the signal presence probability, the noise power spectral density, and the clean signal. The proposed method is tested in various non-stationary noise environments. Compared to single-channel post-filtering, a significantly reduced level of non-stationary noise is achieved without further distorting the desired signal components.

Keywords: Array signal processing, signal detection, acoustic noise measurements, speech enhancement, spectral analysis, adaptive signal processing.