Multi-microphone speaker separation for neuro-steered hearing aids: neural networks versus linear methods

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Neuro-steered noise suppression in hearing devices consists of two main parts: separating and denoising the speech sources in the microphone recordings, and detection of the user's attention. We compared three multi-microphone approaches for the speaker separation and noise-suppression part in such a pipeline: a (linear) multi-channel Wiener filter (MWF), a (non-linear) deep neural network (DNN), or a combination of both where the output of the DNN is used to inform the MWF. The separated speech streams are then used for an EEG-based auditory attention decoding (AAD) module, the result of which decides which audio stream to present to the user. We evaluate the pipeline for 4 different speaker positions and 3 noise conditions and present the improvement in signal-to-noise ratios (SNRs) and AAD accuracies for the three approaches under the different acoustic conditions. While both methods perform well in the easier acoustic conditions, we found that the DNN-only and the DNN-MWF pipeline result in a more robust performance in the more challenging conditions. Finally, we show that the use of more than 1 microphone for source separation has a substantial benefit on the AAD performance over a single-microphone speaker separation.

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