Bootstrapping EEG-based auditory attention detection systems: boundary conditions for background noise and speaker positions

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Hearing prostheses are equipped with noise reduction algorithms that improve speech intelligibility. These algorithms, however, lack information about which speaker the hearing aid user wants to attend to. It has been shown that auditory attention can be decoded from the EEG signals of the listener in a competing talker scenario. Augmenting hearing aid algorithms with this information can pave way to efficient and intelligent noise suppression. *Objective*: Analyze the effect of challenging noise conditions and speaker positions on attention decoding performance. *Methods*: 29 subjects participated in the experiment. Auditory stimuli consisted of stories narrated by 2 speakers from 2 different locations, along with surrounding background noise (babble). EEG signals of the subjects were recorded while they focused on one story and ignored the other. The strength of the babble noise as well as separation between speakers were varied between presentations. Spatio-temporal decoders were trained for each subject, and applied to decode attention of the subjects from every 30s segment of data. *Results*: Our analysis shows that decoding performance was affected by both the background noise level and the angular separation between speakers. For 180 degrees speaker separation, performance is seen to increase with the inclusion of moderate background noise, possibly due to listening effort. We also observe that this benefit of listening effort failed to outweigh the disadvantage of increasing noise when the speakers are closer to each other (60 or 10 degrees) where performance decreased with increasing noise power. We also found a significant correlation between speech intelligibility and attention decoding performance across conditions.