W01b: IMPROVING CHANNEL SELECTION CRITERIA IN N-OF-M STRATEGIES FOR COCHLEAR IMPLANTS

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Approximately 324,000 adults and children in the United States have been fitted with a cochlear implant according to a (2012) report from the National Institute of Health. Popular in clinical cochlear implant devices, the 'n-of-m' sound processing strategies are based on selecting 'n' frequency bands out of 'm' available channels in each stimulation cycle. Channel selection is usually based on dominant spectral energy in each frequency band, e.g. Advanced Combined Encoder (ACE) strategy. Although robust in quiet conditions, such approach is prone to selection of noise-dominant channels at low signal to noise ratios (SNR), which may result in decreased speech intelligibility. Since formant frequencies contain important cues for intelligibility of voiced speech, a supplementary channel selection strategy is proposed to assign priority to frequency channels corresponding to the location of these frequencies, independent of the instantaneous SNR. A hybrid formant estimation algorithm was developed based on existing strategies to determine the first three formant frequencies (F1, F2, and F3) within each speech analysis window and assigned priority to formant channels irrespective of the specific spectral energy content. In this study, the proposed formant-estimation strategy was directly implemented within the ACE processing framework and evaluated with 6 CI subjects using the CCi-Mobile research platform (developed at CRSS-CILab, University of Texas at Dallas). Three strategies were compared: standard ACE strategy, the formants-ACE (fACE) [Ali et al.], and v-fACE (fACE with an additional voiced/unvoiced activity detector). The following tests were used to assess speech recognition of each strategy: IEEE sentences presented in quiet, speech-shaped noise (10 and 5dB SNR), reverberation, and reverberation+noise, AzBio sentences in quiet, multi-talker babble noise (10 and 5dB SNR), CNC words/phonemes. Subjective evaluation indicates improved performance with both fACE and v-fACE compared to standard ACE for reverberant conditions with T60 values of 300 and 600ms. Statistically significant improvement was achieved with the proposed strategies for 5dB SSN and babble noise. The data from this study suggests that formant-priority channel-selection in n-of-m sound processing strategies have potential to improve speech recognition with CIs, especially in adverse listening conditions.

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