SIGMA XI SW REGION RESEARCH CONFERENCE: JANUARY 11-13, 2013

Noise Modeling in Reverberation: A Comparative Study of Speech Intelligibility in Cochlear Implant Users

Hussnain Ali, Oldooz Hazrati, Nirmal Srinivasan, and Philipos C. Loizou

Department of Electrical Engineering, Erik Jonsson School of Engineering and Computer Science
The University of Texas at Dallas, Richardson, TX

Interplay of reverberation and noise in speech adversely affects speech intelligibility for hearing impaired, especially for people using cochlear implants (CI). Two popular models for noise in reverberant environments, Reverberant Noisy (RN) and Noisy Reverberant (NR), were analyzed in this study. RN model, often used by the hearing scientists, assumes that both speech and noise are affected by the room impulse response (RIR). The signal reaching the listeners' ears is a sum of speech and noise, both convolved with RIR. NR model, often used by engineers, assumes that only speech is affected by the RIR. The signal reaching the listeners' ears is a sum of speech convolved with RIR and noise which is not convolved with RIR. NR signal models the scenario in which noise source is closer to the listener and noise is always additive to the convolved speech. The present work investigates the speech intelligibility of CI users in RN and NR listening environments.

Six post-lingually deaf CI users were tested in this study. All listeners were native speakers of American English with at least one year experience with their implants. RIRs were recorded in two reverberant environments: low reverberant (T_{60} = 0.3s) and moderately reverberant (T_{60} = 0.6s). Speech was presented at two signal-to-noise ratios (+15 dB and +10 dB) to the user's best ear through an indigenous, smart-phone based, research interface.

Speech intelligibility in RN model was lower than NR model for all listening conditions. Although speech intelligibility for both the models was low, informal evaluation revealed that the CI users preferred the quality of NR model over its RN counterpart.