Wed 28.04.2021

AI-powered Algorithms for Cochlear Implants (CI) & Hearing Aids (HA)

Meeting Minutes

Possible areas in which AI-powered processing may be useful:

- Situational amplification (e.g. speech in noise, speech in background music, speech-on-speech…etc.)
- Whenever we need smart estimations of the environment (e.g., when there is background noise, we apply a certain strategy compared to quiet situations, or when there is music we apply another strategy)
- Change frequency-to-electrode allocation mapping according to the situation (quite, noise, music…, etc.), however we run the risk that a CI user might not prefer to have their map changed once they get accustomed it.
- Using AI (possibly a genetic algorithm) to automatically fit the frequency-to-electrode allocation map. This is because of the very large parameter space that cannot be explored manually, so an AI algorithm may be used to accomplish this task more efficiently.
- Electro-acoustic stimulation might benefit greatly from AI algorithms in the sense that the algorithm may (de)emphasize the CI/HA according to the listening environment. For example, HA processing might be emphasized if the user is listening to music, whereas the CI processing might be emphasized in situations involving speech for instance.
- AI can be applied to large databases of CI/HA data to find correlations between variables. The challenge here comes with coordinating data/databases from different research centers/groups/labs. One method that could be of potential benefit is the adoption of online testing post-COVID.

Challenges:

- Computational complexity and resultant power consumption. Ideally, we would like to have power-efficient algorithms that can be implemented on a CI/HA processor.
- Benefit in performance. AI-powered algorithms should outperform the standard strategies to motivate their adoption.
- Signal delay. If AI algorithms are executed on an external hardware piece (see whisper.ai for examples of this in the HA world), the transmission delay between receiving the unprocessed signal, applying the algorithm, and then transmitting the processed signal to the earpiece should not exceed acceptable/perceptible standards
- In situational amplification/processing, we might encounter situations in which the algorithm enhances the undesired signal (e.g. background talker) compared to the target signal.