

Programming cochlear implants with artificial intelligence

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Introduction

Fitting a cochlear implant (CI) is challenging because of the variability in the functional results observed between patients, the complexity of the programmable parameters and the increased number of implanted subjects consuming more and more time and money. There is a clear need of artificial agent to offer the most efficient CI fitting at lowest costs. Machine or deep learning are applications of "Artificial Intelligence" (AI) that use predictive algorithms based on data-driven models to predict the optimal solution for a problem. This help to decision-making is used in various medical fields to improve diagnosis, therapeutic targets or health care system processing (Nakajima 2017, Hamel 2017).

Aim

Does AI help CI fitting and does it improve CI outcomes? To respond two methods of programming cochlear implants are compared: the manual fitting method (the audiologist looks for the level of electrical stimulation producing an effective and comfortable hearing perception at each electrode) versus the programming with artificial intelligence FOX. Various CI outcomes are studied in various CI implanted populations to demonstrate the eventual plus-value of AI-Fox: tonal, and speech audiometries, phonetic discrimination, loudness growth, number of fitting sessions.

Results

Manual fitting parameters are rarely statistically modified with time in 40 CI adults followed during 5 years, except for the C-levels. It emphasizes the complexity of the various parameters interactions and changes for the human brain.

AI-Fox proposes the same initial fitting parameters to all the subjects and surprisingly they suite well to the majority of them. It is neuropsychologically interesting. Many parameters are modified in the next sessions taking account of the measured outcomes.

The functional results are good in the 2 methods: tonal thresholds reach normal levels since 1 Month of CI activation, and speech understanding scores since 3 months. But these functional outcomes are more rapidly obtained with less manpower after AI-Fox aided than manual fitting.

Conclusion

AI is approaching and sometimes surpasses human decision-making in CI fitting with reduction of the fitting time. It is still in learning and optimization.