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Archetypal analysis of auditory profiling data towards a clinical test battery

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Introduction

Nowadays, the pure-tone audiogram alone is used for hearing-aid fitting and characterization of the degree of hearing loss. Nevertheless, some hearing-impaired listeners have shown a so-called speech communication handicap even though the audiometry was compensated for by amplification. Plomp (1978) proposed a classification of the hearing loss based on speech intelligibility tests, the “audibility loss” and the “distortion loss”. Therefore, a different fitting strategy may be needed for compensating the deficits of these two different classes.

The aim of the present study is to clarify which tests are needed (in addition to the audiogram) to classify the listeners in different hearing profiles.

Hypothesis

• H1: Hearing-impaired listeners can be grouped in 4 different profiles by identifying trends in the behavioral data. This can be done using unsupervised learning.
• H2: The test used for classifying the subjects can be reduced to only the most relevant tests using supervised learning.

Method

Unsupervised: Dimensionality Reduction: PCA

Test Battery for auditory profiling
Thorp et al. (2016) proposed an extended clinical test battery beyond the audiogram in hearing-aid candidates. In order to verify the hypothesis (fig. 2A). The data were re-analyzed using this approach.

I. Dimensionality Reduction: PCA

II & III. Archetypal analysis and Profile identification

IV. Supervised learning: Classification

The new analysis provides consistent evidence of the existence of different “auditory profiles” in the data.

The most informative predictors for the profile identification of the HI listeners were related to temporal processing, loudness perception and speech perception.

The current approach seems to be promising for analyzing other existing data towards an efficient auditory profiling.

References

