Audiological classification of patient data using expert-based Common Audiological Functional Parameters (CAFPAs)

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The Common Audiological Functional Parameters (CAFPAs) were introduced for the purpose of combining audiological expert knowledge and providing it to the ENT community in a condensed, illustrative way (Buhl et al. 2018, in press). The CAFPAs are abstract parameters that were designed to describe the most relevant functional aspects of a patient’s hearing abilities by summarizing and integrating audiological knowledge from different measurement procedures. The ten parameters describe, e.g., the individual hearing threshold, suprathreshold deficits, or binaural hearing. They act as "bottleneck features" and are aimed to be interpretable by humans as well as machines. The long-term goal of the approach is to set up an audiological diagnostic support tool, i.e., a computer program that supports the ENT specialist with easily accessible statistical information about a large number of patients similar to the patient under consideration.

In a survey, experts classified cases from the Hörzentrum Oldenburg database by determining audiological findings, treatment recommendations, and CAFPAs for single patients. The collected data is used to determine conditional probabilities with the use of Bayes’ rule, e.g., the probability of different treatment recommendations, given the audiogram of a patient. With these probabilities, questions like “Does a patient need a hearing aid or not?” can be answered based on the audiogram or a subset of CAFPAs.

Thereby, a baseline for a classifier is set which maintains interpretability of intermediate results throughout the model, but is also extendable in many directions. For example, the influence of combinations of different audiological measurements or CAFPAs on the recognition performance can be evaluated, i.e., which measurements are needed to determine audiological findings or treatment recommendations with a specific certainty. Comparing the performance, it can be shown if the abstract CAFPAs encode the relevant information, which is an important requirement for their usage as database-independent parameters.