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A likelihood based decoding mechanism for two-channel localization models

Jörg Encke[1,2], Werner Hemmert[1], Mathias Dietz[2]

[1]Bioanaloge Informationsverarbeitung, Technische Universität München, 80797, München, Germany
[2]Medizinische Physik and Cluster of Excellence Hearing4all, Universität Oldenburg, 26111, Oldenburg, Germany

Abstract

Traditionally, the neuronal representation of interaural time difference (ITD) is often modeled using a delay-line mechanism. In contrast to delay-line models which inherently decode ITD, the model proposed here represents interaural phase differences in form of the relative activity between neuron populations located in the two brain hemispheres. Therefore, the localization information is only encoded in specific activities in the two hemispheres. It cannot be directly determined but has to be decoded first. This study proposes a decoder based on likelihood calculations. Instead of decoding a single phase difference for a given hemispheric activity-balance, the likelihood that the observed activity was due to any possible phase difference is calculated. It is shown that applying the decoder separately to different frequency channels, results in a visualization very similar to that of a cross-correlogram used in delay-line models. It is shown that the decoder is able to account for psychoacoustic data, including the bandwidth-dependent lateralization of 1.5 ms delayed noise that previously imposed a problem on two-channel models.