Lehrstuhl für Multimediakommunikation und Signalverarbeitung
Universität Erlangen-Nürnberg

Proposal for a Master Thesis

Topic: **Evaluation of the Spatial Distribution of Ego-Noise employing Multichannel Non-Negative Matrix Factorization**

Description: Mobile robots generate significant self-induced noise, e.g., by its mechanical joints and motors, which is referred to as ego-noise. Its suppression in recorded microphone signals is of vital importance for robot audition, e.g., understanding what a nearby human has uttered. A powerful algorithm for suppressing structured noise sources, i.e., ego-noise, is termed *Multichannel Non-Negative Matrix Factorization* (MNMF).

MNMF employs a dictionary learning methodology for approximating observed microphone signal *cross power spectral density matrices* (CPSDs) of different sources as linear combination of atomic patterns representing possibly spatially distributed ego-noise sources, e.g., different mechanical joints and talking humans. These CPSD estimates are subsequently employed in a Wiener filter-based noise suppression algorithm. The spatial information of the learned dictionary entries can also be used for localization.

The goal of the thesis is to interpret the spatial information contained in the atomic patterns and subsequently implement a localization algorithm for extracting, i.e., Direction of Arrivals (DoA). Based on this localization information, the spatial distribution of ego-noise sources should be analysed for recorded data. Finally, the model of existing ego-noise suppression approaches should be assessed with respect to their physically motivated spatial model.

As prerequisites, the student should have Matlab programming skills and an affinity to math.

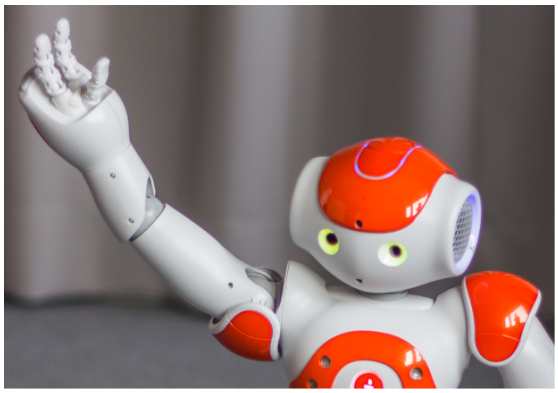

Figure 1: Humanoid robot Nao

[1]: H. Sawada, H. Kameoka, S. Araki, and N. Ueda, "Multichannel Extensions of Non-Negative Matrix Factorization With Complex-Valued Data," IEEE Audio, Speech, Language Process., May 2013.

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Available: Immediately