Lehrstuhl für Multimediakommunikation und Signalverarbeitung
Universität Erlangen-Nürnberg

Proposal for a research internship

Experimental verification of a robust Object-Related Transfer Function-based data-independent beamformer design

Beamforming is a spatial filtering technique, which aims at extracting a desired signal arriving from a certain direction while attenuating signals from other directions. When beamforming is applied to a robot audition scenario, the beamformer design has to take the influence of the humanoid robot's head on the sound field into account, which can be done by incorporation the robot's object-related transfer functions (ORTFs) into the beamformer design. In [Barfuss et al, 2017][1] an ORTF-based robust least squares (RLS) beamformer design was presented, which allows for a tradeoff between directivity and robustness of the resulting beamformer.

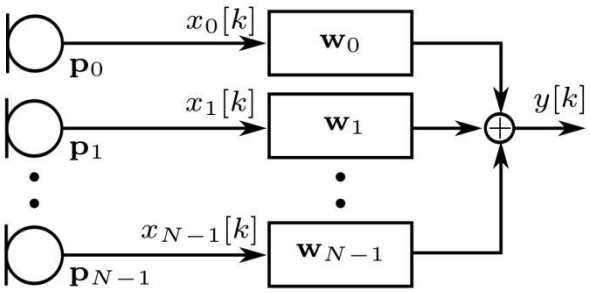

Figure 1: Block diagram of a filter-and-sum beamformer.

Figure 2: 12-microphone head for the NAO robot.

In this internship, the beamformer design of [Barfuss et al, 2017] shall be experimentally verified by measuring its spatial selectivity in an anechoic chamber. For the beamformer design, measured and simulated ORTFs shall be investigated. Furthermore, the impact of distance errors of the design ORTFs on the beamformer's spatial selectivity shall be analyzed. If time allows for it, the performance of the two beamformers based on measured or simulated ORTFs shall also be compared in recorded scenarios by means of signal-dependent measures.

Implementation and evaluation are to be done using MATLAB. A well-structured and well-commented code has to be handed in at the end of the thesis. The thesis/report can be written in German or English.

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Prerequisites:	MATLAB programming, Course Digital Signal Processing
Available:	May /June 2018

[1] [Barfuss et al, 2017] H. Barfuss, J. Podschus, M. Buerger, W. Kellermann, *HRTF-based two-dimensional robust least-squares frequency-invariant beamformer design for robot audition*, HSCMA, 2017