Lehrstuhl für Multimediakommunikation und Signalverarbeitung
Universität Erlangen-Nürnberg

Proposal for a Forschungspraktikum

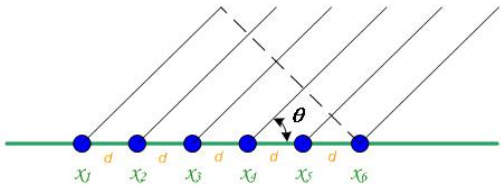
Topic: **Sparsity-based DoA Estimation in Acoustic Sensor Networks**

Description: Since two decades, Multichannel Blind Source Separation (BSS) algorithms have been developed to separate the signals of multiple point sources from each other. The attribute 'blind' refers to the fact that these algorithms do not need geometric information on the positions of the sources and the sensors.

Most BSS algorithms are based on the assumption of sparsity of the sources, i.e., that in a speech mixture only one source is active at a time/frequency tile such that the corresponding short-time Fourier spectra of the individual sources do not overlap. Using this assumption, the directions of arrival (DOAs) are estimated in each time-frequency bin and clustered afterwards. In the end, the clusters allow to estimate the number of sources, the DoA's and the activity of the underlying speech components [1], [2].

The aim of this research project is the implementation and the evaluation of algorithms for the estimation of the DoA's of speakers in an observed mixture. This includes a literature survey of state of the art methods. Promising approaches should be investigated for different acoustical scenarios to compare their performance. Approaches for acoustical sensor networks are of special interest for this thesis.

As prerequisites, the student should have interest in machine learning and basic MATLAB programming experience.



https://en.wikipedia.org/wiki/Sensor_array

[1]: Araki, S., Sawada, S., Mukai, R., and Makino, S. *DOA Estimation for Multiple Sparse Sources with Arbitrarily Arranged Multiple Sensors.* Journal of Signal Processing Systems 63, no. 3 (June 2011): 265–75.

[2]: Araki, S., Nakatani, T., Sawada, H. and Makino, S. *Blind Sparse Source Separation for Unknown Number of Sources Using Gaussian Mixture Model Fitting with Dirichlet Prior*, 33–36. IEEE International Conference on Acoustics, Speech and Signal Processing, 2009. (ICASSP 2009).

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