

Proposal for a Master Thesis

Topic:

Analysis and Control of Adaptive Microphone Arrays

Description: Robot audition describes the research area that aims at providing humanoid robots with 'technical ears' to allow, e.g., reaction to acoustic events and speech communication with humans. For this, robots need to be equipped with microphone arrays to capture the surrounding acoustic scene. So far, research has largely focused on static array configurations, e.g., mounted on the robot's head [1]. The fact that most robots consist of moving parts allows, however, adaptive microphone topologies as well, e.g., see Figure 1. The obvious question is then how the array topologies should be adapted?

The goal of the thesis is to implement a control algorithm for adapting the aperture of a microphone array conceptually similar to [2]. The method uses the array design algorithm proposed in [1]. The idea is to adapt the aperture to maximize the weighted effective rank [3]. Hereby, weighting accounts for a desirable frequency range and online-knowledge, i.e., the estimated position of the source.

As prerequisites, the student should have a strong interest in signal processing, affinity to math and Python programming experience.



Figure 1: Humanoid robot NAO

- V. Tourbabin and B. Rafaely, "Theoretical Framework for the Optimization of Microphone Array Configuration for Humanoid Robot Audition," *IEEE/ACM Transactions on Audio, Speech, and Language Processing*, 2014.
- [2] H. Barfuss and W. Kellermann, "Improving blind source separation performance by adaptive array geometries for humanoid robots," *HSCMA*, 2014.
- [3] O. Roy and M. Vetterli, "The Effective Rank: A Measure of Effective Dimensionality," *EUSIPCO*, 2007.

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Available: Immediately