

Master Thesis

Binaural Reproduction of Multi-Loudspeaker Setups

The recent trend of spatial music production and Dolby Atmos has led to an increased demand for headphone-based binaural reproduction of multi-loudspeaker setups, allowing immersive audio productions with a simplified setup and headphones [1-3]. There are several approaches to create a virtual representation of a control room with a multi-loudspeaker setup, such as acoustic simulations, parametric synthesis of binaural room impulse responses (BRIRs), or BRIR measurements, to name a few.

The goal of this master thesis is to create virtual multi-loudspeaker setups that allow for full-spherical head movements of the listener based on (individual) BRIR measurements for only a few head orientations. Using spatial upsampling algorithms suitable for BRIRs [4], impulse responses for arbitrary head orientations should be generated on a so-called dense sampling grid based on the initial measurements. The resulting BRIRs should be evaluated according to technical parameters in comparison to dense reference BRIRs. Furthermore, a listening experiment should be performed to compare the (individualized) binaural reproduction of the multi loudspeaker setup with its real counterpart regarding perceptual qualities such as coloration or externalization.

Literature

- [1] *dearVR MONITOR*. Retrieved September 06, 2023, from <https://www.dear-reality.com/products/dearvr-monitor>
- [2] *APL Virtuoso*. Retrieved September 06, 2023, from <https://apl-hud.com/apl-virtuoso-coming-soon/>
- [3] *Waves Abbey Road Studio 3*. Retrieved September 06, 2023, from <https://www.waves.com/plugins/abbey-road-studio-3>
- [4] Lübeck, T., Arend, J. M., & Pörschmann, C. (2023). Spatial Upsampling of Sparse Spherical Microphone Array Signals. *IEEE/ACM Transactions on Audio, Speech, and Language Processing*, 31, 1163–1174. <https://doi.org/10.1109/TASLP.2023.3250841>

Requirements

Basic knowledge of spatial hearing, BRIRs, and audio signal processing in Matlab and Python. Basic knowledge or willingness to learn tools such as pyBinSim, SoundScape Renderer, Unreal Engine, or Unity to implement the listening experiment.

Supervision

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