Beam Steering for A Speaker Tracking-Based First-Order Differential Microphone Array

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***Abstract*— In the real world, noise can impair both the quality and the intelligibility of speech signals. To reduce the effect of diffuse noise and reverberation interference, one can try to design a robust set in terms of digital signal processing algorithms and hardware parts of electroacoustic devices, such as microphone arrays. Microphone arrays are employed widely in the purpose of de-reverberation, sound localization, and noise reduction of the speech signal.**

This work tries to suggest an adaptive method for optimization of the directivity controlling parameter (α) (or steering parameter) of differential microphone arrays (DMAs) in the sense that this parameter changes adaptively to steer the beam pattern of the microphone array in the desired direction. In other words, a beam-controlled version of the first-order steerable differential array (FOSDA), will be introduced.

Interestingly and simply, the adaptive FOSDA lets a speaker move freely in a room (like changes in his/her location over time in a conference room) while it tracks a speaker's location and the beam direction sets electronically to its corresponding angle. Advantageously, adaptive approach adds speaker's free move, as a degree of freedom, to FOSDA. Modeling time difference of arrival (TDOA) from speaker to channels of microphone array by Gaussian Mixture Model (GMM), estimating the azimuth angle of the sound source location by employing Kalman filter, its extensions, or other Bayesian estimators, and utilizing this estimated angle to find the value of the directivity controlling parameter lead to steering the beam response of the first-order azimuthal steerable microphone array adaptively. The proposed method gives rise to a robust design for first-order steerable differential microphone arrays in terms of de-reverberation and noise/interfere point suppression. Eventually, this adaptive algorithm is expected to yield better SNR values and an optimized directivity factor.

Keywords—Steerable Microphone Array; Differential Microphone Array; Sound Localization; Beam-pattern

Either Poster or Podium

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