# A probabilistic model for robust acoustic localization based on an auditory front-end

Acoust. Soc. Am., vol. 116, 3075-3089). For two well-separated speakers in quiet the estimation error is generally less or equal 10°. In noisy environments a single speaker can be localized with an error of less than 20°, even for a signal-to-noise ratio of 0 dB.

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**A Probabilistic Model for Robust Acoustic Localization based on an Auditory Front-end**

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Although extensive research has been done in the field of localization, the degrading effect of reverberation and the presence of multiple sources on localization performance has remained a major issue. The classical approach to localize an acoustic source in the horizontal space is to search for the main peak in the cross-correlation function, which corresponds to the interaural time difference (ITD) between both ears. Apart from ITD, the interaural level difference (ILD) can contribute to localization, especially at higher frequencies where the wavelength becomes smaller than the diameter of the head, leading to ambiguous ITD information. Motivated by the robust localization performance of the human auditory system, its peripheral stage is used as a front-end for binaural cue extraction. The interdependency of ITD and ILD on azimuth is a complex pattern that depends also on the room acoustics and is therefore learned by azimuth-dependent Gaussian mixture models. Multi-conditional training is performed to incorporate the spread of the binaural features caused by multiple sources and the effect of reverberation. The trained localization model outperforms state-of-the-art localization techniques in simulated adverse acoustic conditions. Furthermore, the model is capable of generalizing to changes in the simulated room absorption and to unknown source/receiver combinations.

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**The effect of spectral density and bandwidth on the precedence effect**

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The precedence effect shows the ability of the auditory system to perceptually suppress reflections such that a single sound is heard at the direction of the leading sound. A low frequency tone is localized on the basis of its interaural phase, but the addition of its delayed copy alters the interaural phase and thus its location. A larger bandwidth is needed to stabilize localization at the lead either through integrating binaural information across frequency or through extracting information from the temporal envelope. Increased spectral density will give rise to faster envelope fluctuations within an auditory filter, thus facilitating the evaluation of binaural cues from the envelope.