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Unsupervised Blind Joint Dereverberation and Room Acoustics Estimation with Diffusion Models

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We present an unsupervised method for single-channel blind dereverberation and room impulse response (RIR) estimation, called BUDDy. The algorithm is rooted in Bayesian posterior sampling: it combines a likelihood model enforcing fidelity to the reverberant measurement, and an ane- choic speech prior implemented by an unconditional diffusion model. We design a parametric filter representing the RIR, with exponential decay for each frequency subband. Room acoustics estimation and speech dereverberation are jointly carried out, as the filter parameters are iteratively estimated and the speech utterance refined along the reverse diffusion trajectory. In a blind scenario where the room impulse response is unknown, BUDDy successfully performs speech dereverberation in various acoustic scenarios, significantly outperforming other blind unsupervised baselines. Unlike supervised methods, which often struggle to generalize, BUDDy seamlessly adapts to different acoustic condi- tions. This paper extends our previous work by offering new ex- perimental results and insights into the algorithm's performance and versatility. We first investigate the robustness of informed dereverberation methods to RIR estimation errors, to motivate the joint acoustic estimation and dereverberation paradigm. Then, we demonstrate the adaptability of our method to high- resolution singing voice dereverberation, study its performance in RIR estimation, and conduct subjective evaluation experiments to validate the perceptual quality of the results, among other contributions.

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