ACOUSTICS2008/2945
Bayesian single channel blind speech dereverberation using Monte Carlo methods

James Hopgood[a], Christine Evers[a] and Judith Bell[b]
[a]Institute for Digital Communications, The University of Edinburgh, School of Engineering and Electronics, Alexander Graham Bell Building, The King's Buildings, Mayfield Road, EH9 3JL Edinburgh, UK
[b]Heriot Watt University, School of Engineering and Physical Sciences, Riccarton, EH14 4AS Edinburgh, UK

Audio signals in confined spaces exhibit reverberation due to reflections off surrounding obstacles. Moreover, the signal is distorted by noise, usually modeled as an additive signal observed within the room, independent of the microphone's location, and unaffected by the acoustics. Reverberation and noise cause significant deterioration of audio quality and intelligibility to signals recorded in acoustic environments. Bayesian blind dereverberation infers knowledge about the system by exploiting the statistical properties of speech and the acoustic channel. In the Bayesian framework, the reverberant and noisy signal can be enhanced by processing it either sequentially using online methods or in a batch using offline methods.
This paper compares several distinct Bayesian approaches for single-channel blind speech dereverberation. These include Markov chain Monte Carlo methods for batch processing, and sequential Monte Carlo (particle filtering) methods for online processing. In the batch method, static parametric models are used for modeling the statistics of the speech and channel. Optimal parameter estimates are then used to enhance the observed signal. In the sequential approach, the clean speech signal is considered itself an unknown state. Various dynamical models and optimal sampling strategies are discussed for state estimation. The results demonstrate the superiority of the sequential method.