Bayesian NMF toolkit (BNMF-Tool)

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Bayesian NMF toolkit (BNMF-Tool) implements the Bayesian NMF for KL divergence [1,3]. The implementation is based on an NMF class (@NMF) that includes all the relevant functions. The usage of this class is demonstrated in demo.m in which BNMF is used for supervised and unsupervised noise reduction proposed in [1,2]. When you run demo in Matlab, make sure that the directory that includes @NMF is in the Matlab search path.

Citation: N. Mohammadiha, P. Smaragdis and A. Leijon, "Supervised and Unsupervised Speech Enhancement Using Nonnegative Matrix Factorization," IEEE Trans. Audio, Speech, and Language Process., vol. 21, no. 10, pp. 2140–2151, oct. 2013

The following is a short description of the demo.

Supervised noise reduction: The basis matrices of speech and noise are trained offline and then noise reduction is performed. Important parameters:

Table 1: Parameters for "supervised" method

Variable name in demo	Role	Notation in the paper [3]
method (demo.m)	Chooses between 'supervised' or online 'options'	
num_speech_basis (demo.m)	Number of speech basis	$I^{(s)}$
num_noise_basis (demo.m)	Number of noise basis	$I^{(n)}$

a_noise (demo.m)	Shape parameter of the gamma priors for the activation of noise basis. This is noise dependent and should be set empirically. For online method, only one value (independent of noise) is set.	$\phi^{(n)}$ in section III-C
a_speech (demo.m)	Shape parameter of the gamma priors for the activation of the speech basis.	$\phi^{(s)}$ in section III-C

Unsupervised noise reduction: speech basis are learned offline but noise basis matrix is learned online.

Table 2: Parameters for "online" method

Variable name in demo	Role	Name is the paper [3]
Method (demo.m)	Chooses between 'supervised' or online 'options'	
num_speech_basis (demo.m)	Number of speech basis	$I^{(s)}$
num_noise_basis (demo.m)	Number of noise basis to be learned online	$I^{(n)}$
a_noise (demo.m)	Shape parameter of the gamma priors for the activation of noise basis that are learned online. This is independent of noise type.	$\phi^{(n)}$ in section III-C
a_speech (demo.m)	Shape parameter of the gamma priors for the activation of the speech basis.	$\phi^{(s)}$ in section III-C
noise_data (demo.m)	The main buffer for noise basis adaption.	$\underline{\boldsymbol{n}}$ in section III-B
size_local_buffer (BNMF_Factorization_oneFrame .m)	The local buffer for noise basis adaption.	$\underline{\boldsymbol{m}}$ in section III-B

References:

[1] N. Mohammadiha, P. Smaragdis and A. Leijon, "Supervised and Unsupervised Speech Enhancement Using Nonnegative Matrix Factorization," IEEE Trans. Audio, Speech, and Language Process., vol. 21, no. 10, pp. 2140–2151, oct. 2013

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[3] A. T. Cemgil, "Bayesian inference for nonnegative matrix factorisation models," Computational Intelligence and Neuroscience, vol. 2009, 2009, article ID 785152, 17 pages.