This folder contains implementations of objective measures (Chapters 10 and 11):

MATLAB file	Description	Reference
comp_snr.m	Overall and segmental SNR	[1]
comp_wss.m	Weighted-spectral slope metric	[2]
comp_llr.m	Likelihood-ratio measure	[3]
comp_is.m	Itakura-Saito measure	[3]
comp_cep.m	Cepstral distance measure	[4]
comp_fwseg	Freq. weighted segm. SNR (fwSNRseg)	[5],Chap 11, Eq. 11.5
comp_fwseg_variant	Frequency-variant fwSNRseg measure	Chapter 10, Eq. 10.24
comp_fwseg_mars	Frequency variant fwSNRseg measure based on MARS analysis	Chap 10, Sec. 10.5.4
pesq.m	PESQ measure	[6]
composite.m	A composite measure	[7]
addnoise_asl.m	Adds noise to the clean signal at specified SNR based on active speech level.	[8]

USAGE

```
>>   [snr_mean, segsnr_mean]= compSNR(cleanFile.wav, enhdFile.wav);
      where 'snr_mean' is the global overall SNR and 'segsnr_mean' is the
      segmental SNR.

>>   wss_mean = comp_wss(cleanFile.wav, enhancedFile.wav);

>>   llr_mean= comp_llr(cleanFile.wav, enhancedFile.wav);

>>    is_mean = comp_is(cleanFile.wav, enhancedFile.wav);

>>    cep_mean = comp_cep(cleanFile.wav, enhancedFile.wav);

>>    fwSNRseg = comp_fwseg(cleanFile.wav, enhancedFile.wav);

>>    [SIG,BAK,OVL]=comp_fwseg_variant(cleanFile.wav, enhancedFile.wav);
        where   'SIG' is the predicted rating of speech distortion,
                'BAK' is the predicted rating of background noise distortion,
                'OVL' is the predicted rating of overall quality.

>>    [SIG,BAK,OVL]=comp_fwseg_mars(cleanFile.wav, enhancedFile.wav);

>>    pesq_mean = pesq(cleanFile.wav, enhancedFile.wav);
               Only sampling frequencies of 8000 Hz or 16000 Hz are supported.

>>    [Csig,Cbak,Covl]=composite(cleanFile.wav, enhancedFile.wav);
        where   'Csig' is the predicted rating of speech distortion,
                'Cbak' is the predicted rating of background noise distortion,
                'Covl' is the predicted rating of overall quality.

>>      addnoise_asl(cleanfile.wav, noisefile.wav, outfile.wav, SNRlevel)
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[4] Kitawaki, N., Nagabuchi, H., and Itoh, K. (1988). Objective quality evaluation for low bit-rate speech coding systems. IEEE J. Select. Areas in Comm., 6(2), 262-273.

[5] Tribolet, J., Noll, P., McDermott, B., and Crochiere, R. E. (1978). A study of complexity and quality of speech waveform coders. Proc. IEEE Int. Conf. Acoust. , Speech, Signal Processing, 586-590.

[6] ITU (2000). Perceptual evaluation of speech quality (PESQ), and objective method for end-to-end speech quality assessment of narrowband telephone networks and speech codecs. ITU-T Recommendation P. 862

[7] Hu, Y. and Loizou, P. (2006). Evaluation of objective measures for speech enhancement. Proc. Interspeech

[8] ITU-T (1993). Objective measurement of active speech level. ITU-T Recommendation P. 56

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