Present folder contains implementations of ideal channel selection (ICS) algorithms based on different selection criteria (as presented at CIAP'11 conference). For the SNR selection criterion, ICS is also known in the literature as ideal binary mask (see review in book by Wang and Brown, 2006, Wiley/IEEE Press). References for the other selection criteria are provided at the end of this file, and are available from our website.

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Usage: ics(noisefile, clfile, outfile, nsnr, thrd)

% noisefile - name of masker file
% clfile - name of clean stimulus file
% outfile - name of output file
% nsnr is the overall input SNR (in dB) for noisy file
% thrd is the SNR threshold (in dB)

Examples:

In MATLAB, type:

```
>> ics('babble1.wav','S_01_01.wav','out.wav',-10,-5)
```

For the above example, input SNR=-10 dB and SNR threshold=-5 dB.
The noisy (mixture) file is contained in 'S_01_01-noisy.wav' file.
Segregated file is in 'out.wav'

The wav files can be played via a Media Player, Cool Edit, Audition, etc.
It can also be viewed and played through our toolbox 'Colea':
http://www.utdallas.edu/~loizou/speech/software.htm

Reference:
Li, N. and Loizou, P. (2008). "Factors influencing intelligibility of ideal binary-masked speech: Implications for noise reduction," Journal of Acoustical Society of America, 123(3), 1673-1682

% ---------- ----------competing-talker demo ----------

Demo of separating two talkers speaking simultaneously:

Usage: ics_competing_talker(filename, clfile, t_outfile, m_outfile,thrd)

% filename - mixture filename
% clfile - clean target filename
% t_outfile - output file: Target talker
% m_outfile - output file: Competing talker
% thrd - SNR threshold in dB

Example:

```
>> ics_competing_talker('talker_mixture.wav','S_01_10.wav','target.wav','masker.wav',-5)
```

In 'talker_mixture.wav' mixture file, the competing talker was added at SNR=-5 dB
(target and competing talkers were same for this example).
Files 'target.wav' and 'masker.wav' contain processed sentences of the segregated target and competing-talker talkers respectively. The SNR threshold was set to -5 dB.

%---------- constraint rule ----------

Usage: ics_constr_rule(filename, clfile, outfile, GAIN)

% filename - noisy speech filename (mixture)
% clfile - clean speech filename
% outilfe - name of output file
% GAIN='Wiener'; 'MMSE', 'logMMSE', 'MMSE-SPU'; 'pMMSE'; 'SpecSub'

Example:

>> ics_constr_rule('S_01_02-babble_m10dB.wav', 'S_01_02.wav','out_constr.wav','Wiener')

Target was corrupted with babble at -10 dB SNR. The Wiener gain function was used.
Other possible gain functions: 'MMSE', 'logMMSE', 'MMSE-SPU'; 'pMMSE'; 'SpecSub'

Example with competing-talker:
>> ics_constr_rule('talker_mixture.wav','S_01_10.wav','out.wav','Wiener')

Another example in babble at input SNR=-5 dB
>> ics_constr_rule('S_02_02-babble_m5dB.wav', 'S_02_02.wav','out_constr.wav','Wiener')

References
Kim, G. and Loizou, P. (2011). “Gain-induced speech distortions and the absence of intelligibility benefit with existing noise-reduction algorithms,” J. Acoust. Soc. Am. 130(3), 1581-1596.

Loizou, P. and Kim, G. (2011). "Reasons why Current Speech-Enhancement Algorithms do not Improve Speech Intelligibility and Suggested Solutions," IEEE Trans. Audio, Speech, Language Processing, 19(1), 47-56.

% ---------- reverberation rule ----------

Usage: ics_reverb(reverbfile, clfile, outfile, thrd)

% reverbfile - name of file containing reverberated stimulus
% clfile - name of clean sentence file
% outfile - name of output (processed) file
% thrd is the threshold (in dB) for signal-to-reverberant ratio criterion

Example:

>> ics_reverb('rev800_2.wav','clean_2.wav','outrev.wav',-8)

File was corrupted with RT60=0.8 sec reverberation.
The signal-to-reverberant ratio (SRR) threshold was set to -8 dB.

Reference
Kokkinakis, K., Hazrati, O. and Loizou, P. (2011). "A channel-selection criterion for suppressing reverberation in cochlear implants," Journal of the Acoustical Society of America, 129(5), 3221-3232.

%---------- masker-based rule ----------

Usage: ics_masker_rule(filename, clfile, outfile)

% filename - noisy speech filename (mixture)
% clfile - clean speech filename
% outilfe - name of output file

Example file corrupted at -10 dB SNR with babble:

>> ics_masker_rule('S_01_02-babble_m10dB.wav','S_01_02.wav','out_masker_rule.wav')

Reference:
Kim, G. and Loizou, P. (2010). "A new binary mask based on noise constraints for improved speech intelligibility," Proc. INTERSPEECH, Makuhari, Japan, pp. 1632-1635.

REFERENCES

Publications (from our lab) assuming ideal conditions:
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Hu, Y. and Loizou, P. (2008). "A new sound coding strategy for suppressing noise in cochlear implants," Journal of Acoustical Society of America, 124(1), 498-509.

Kim, G. and Loizou, P. (2011). “Gain-induced speech distortions and the absence of intelligibility benefit with existing noise-reduction algorithms,” J. Acoust. Soc. Am. 130(3), 1581-1596.

Kim, G. and Loizou, P. (2010). "A new binary mask based on noise constraints for improved speech intelligibility," Proc. INTERSPEECH, Makuhari, Japan, pp. 1632-1635.

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Li, N. and Loizou, P. (2008). "Factors influencing intelligibility of ideal binary-masked speech: Implications for noise reduction," Journal of Acoustical Society of America, 123(3), 1673-1682

Li, N. and Loizou, P. (2008). "Effect of spectral resolution on the intelligibility of ideal binary masked speech," Journal of Acoustical Society of America, 123(4), EL59- EL64

Loizou, P. and Kim, G. (2011). "Reasons why Current Speech-Enhancement Algorithms do not Improve Speech Intelligibility and Suggested Solutions," IEEE Trans. Audio, Speech, Language Processing, 19(1), 47-56.

Publications (from our lab) assuming realistic conditions:
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Hu, Y. and Loizou, P. (2008). "Techniques for estimating the ideal binary mask,&" Proc. of 11th International Workshop on Acoustic Echo and Noise Control, September 14th-17th, Seattle, Washington.

Hu, Y. and Loizou, P. (2010). "Environment-specific noise suppression for improved speech intelligibility by cochlear implant users," Journal of the Acoustical Society of America, 127(6), 3689-3695.

Kim, G., Lu, Y., Hu, Y. and Loizou, P. (2009). "An algorithm that improves speech intelligibility in noise for normal-hearing listeners," Journal of the Acoustical Society of America, 126(3), 1486-1494

Kim, G. and Loizou, P. (2010). "Improving Speech Intelligibility in Noise Using Environment-Optimized Algorithms," IEEE Trans. Audio, Speech, Language Processing, 18(8), 2080-2090.

Kim, G. and Loizou, P. (2010. "Improving Speech Intelligibility in Noise Using a Binary Mask that is Based on Magnitude Spectrum Constraints, " IEEE Signal Processing Letters, 17(2), 1010-1013

Kim, G. and Loizou, P. (2009). "A data-driven approach for estimating the time-frequency binary mask," Proc. Interspeech, Brighton, UK, Sept 6-9, 2009