Silence Detection

Instruction

We detect silent windows in the audio stream by paying attention to the variability in the audio signal. Speech or noise will yield a signal that is variable, while the absence of speech or noise will result in a non-variable signal showing no positive or negative peaks. In small non-overlapping windows of 0.01 s (Parameter1: 'winMinMax' = 0.01), we calculate all the absolute differences between signal maximum and signal minimum for each window of a file, representing signal variability. Windows with low signal variability are associated with silence (small signal range due to the absence of peaks). Looking at the distribution of all maximum to minimum distances of all windows of a session in a histogram, one notices its positive skewness. This derives from the fact, that silence episodes will always yield the same (or highly similar) absolute maximum to minimum distances in their respective window and result in a high occurrence rate to the left of the histogram (the small variability values). We used Scott's Rule (Scott, 2010) to determine the adequate number of bins of the histogram. An adaptive cut-off value is then chosen, being an adaptive absolute maximum to minimum signal distance. If a window shows signal variability below this value, we classified the window as silence, if above, the window was classified as non-silence. This cut-off is applied to non-overlapping windows of 0.1 s (Parameter2: 'winOutput' = 0.1) in width. In order to choose a fitting cut-off value auditory probes are necessary. Cut-off selection can vary due to different recording environments. With our data, we achieved very satisfying results when choosing the right edge of the third bin to the right of the bin with maximum counts (Parameter3: 'cutOff' = 4). Parameters can be changed, proposed values here created good results in our data set.

Recommended parameters: 'winMinMax' = 0.01, 'winOutput' = 0.1, 'cutOff' = 4

When setting the windows that show signal variability below the cut-off to 0, one can listen to the signal that now contains only non-silence windows and inspect the functionality of the cut-off value.

Dependencies: (included)

Scott, D. W. (2010). Scott's rule. Wiley Interdisciplinary Reviews: Computational Statistics, 2(4), 497-502.

calcbins.mat, Richard Cotton (2009):
https://ch.mathworks.com/matlabcentral/fileexchange/21033-calculate-number-of-bins-for-histogram?focused=5103618&tab=function

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