Using the segmentation functions.

LSS 12 April 2019.

There are two m-functions which compute the segmentations either in a very simple way, or in a less simple way, using LIF neurons. These are

function [segments] = findsegments\_1(fname,sigma1, sigmaratio, dtperelement, nsamples, varargin)

and

function [segments] = findsegments\_2(fname,sigma1, sigmaratio, dtperelement, nsamples, varargin)

They are designed to be complementary, so that they can be reasonably easily compared. The common parameters are:

fname: file name containing the sound (uncompressed .wav)

sigma1: faster of the two Gaussians used in finding the onset and offset signals

sigmaratio: ratio of the sigma valus for the Gaussians

dtperelement: simply 1/sampling rate

nsamples: number of samples used in the difference of Gaussians. Note that this will depend on the sampling rate as well

varargin is used to set many other parameters

For findsegments\_1, the values are

Mincochfreq: minimum frequency for the bandpass filters:

Maxcochfreq: maximum frequency for the bandpass filters

n\_erbs: band-width for the Gammatone filter bank

nfilt: number of filters used in the filter bank

smoothlength: Bartlett filter parameter length of triangular (Bartlett) window used to smooth rectified signal prior to half difference of Gaussian filtering (in seconds)

threshold: used to determine whether peaks in the onset and offset signals are large enough to signify a segment

g\_quiet: used to determine whether a later onset should be incorporated into the previous segment

k\_minmin: not actually used

segstartadjust: used to see whether a segment start should be moved back to the previous positive-going zero crossing from the in itial candidate, which is a peak.

Minseglength: minimum permitted length of a segment.

For findsegments\_2, most of the above are used (not quiet, k\_minmin or segstartadjust), and there are, in addition the following varargin parameters:

onset\_diss: dissipation of LIF neurons to which the onset signals are applied (i.e. dissipation of neurons calculating candidate segment starts)

onset\_rp: refractory period of onset LIF neurons

onset\_wt: weight from onset signal to onset LIF neuron. Note that if convergence > 0 this is shared between the different onset signals applied to the LIF neurons.

offset\_diss: as onset\_diss but for offset neurons (i.e. for segment end calculation)

offset\_rp: as onset\_rp, but for offset LIF neurons

offset\_wt: as onset\_wt, but for offset neurons

convergence: sets the number of onset (offset) channel inputs applied to each LIF neurons. If 0, then only the channel for this neuron is used. There are 2 \* convergence + 1 inputs used at each LIF neuron.

Summarysteplength: used in calculation of summation of onset (offset) spikes; bucket size used.

Summaryintegratelength: length of time onset (offset) spikes are used in summarizing. Normally an integer multiple of Summarysteplength

Shortestsegment: see discussion of findsegments\_2.m

As well as these two functions there are two functions

function [nFiles] = findsegments\_all(soundDirectory,soundFileList, outputDirectory, varargin)

and

function [nFiles] = findsegments\_all\_2(soundDirectory,soundFileList, outputDirectory, varargin)

which call findsegments\_1 and findsegments\_2 respectively. Both return the number of files processed.

The common parameters are

soundDirectory: directory containing the sounds

soundFileList: file containing the names of the files to be processed.

outputDirectory: name of directory here outputs are to be stored. The files created are called [filenameroot{1} filesuffix] '\_segs.mat'] where filenameroot{1} is the filer name root, filesuffix is a string that can be set using the varargin parameter (to enable the files from different runs to be identified). Each file contains the segmentation, and a variable called params which holds the parameter settings used.

The other varargin parameters allow setting of these values in the called functions from this function.

This all works reasonably well. There is also an extra pair of functions:

function segments = run\_multiplesegmentations(sd, filelist, nfilters)

and

function segments = run\_multiplesegmentations\_2(sd, filelist, nfilters, varargin)

which are used to vary the number of bandpass channels used (they also give a guide as to how other functions might be built up).

The parameters are

Sd: the directory containing the datasets to be processed

Filelist: the name of the file containing the name of the file to be processed (note: these functions just process a single file)

Nfilters: the number of filters to be used. (For run\_multiplesegmentations\_2, one can use varargin to set the minimum number of filters as well).

In addition, in the directory stimuli\_2019, there are a few files with speech and noise. The system works well for narrowband noise (here, a 440Hz sine), but less well for wideband noise (here, white noise). You should try out the system with these.