CSE 5539-0010 - Spring 2019

Programming Assignment: **Pitch Detection by Correlogram**

Due: March 4 (Monday)

(If you are NOT a student in the college of engineering, you may do something else in lieu of the programming assignment. In this case, you must contact the instructor right away.)

Description

English vowels have a steady fundamental frequency (F0), or pitch. As discussed in the class, a correlogram is a widely used model for pitch detection. Perform pitch detection for the two synthetic vowels: /ar/ and /er/, using the correlogram algorithm (Eq. 4) given by Wang and Brown in their paper published in *IEEE Transactions on Neural Networks*, Vol. 10, pp. 684-697, 1999 (available on Wang's website). You need to calculate a correlogram for each frequency channel and a summary correlogram. Peak detection is then applied to find the pitch frequency.

The outputs from hair cell transduction have already been calculated, and are provided as "ar0.dat", "er4.dat", available under "http://www.cse.ohio-state.edu/~dwang/teaching/cse5539/".

Implementation details

The original signals of the two vowels are in "ar0.sig" and "er4.sig", available under the same directory. Have a listen to them first by converting into ".wav" files using the "wavwrite()" function in MATLAB (remember to normalize the signal before transformation); Such .wav files are also provided under the directory.

The signals have already been processed by a bank of gammatone filters with 64 channels, and subsequently transduced by the Meddis hair cell model. These channels span a frequency range of 80-4000 Hz, arranged logarithmically. Thus, you need to calculate a correlogram of only 64 channels.

The original signals are sampled at 10 KHz. So you need to adjust the value of K to 200 (window width, see the paper) and L to 125 (longest lag) accordingly. For peak detection in the summary correlogram, limit your F0 search range to 80 Hz to 222 Hz.

The files "ar0.dat" and "er4.dat" are in text form. In each file, data points are first ordered by time steps, within each of which they are further ordered by frequency with the lowest frequency first. Each file contains a total of 325x64 data points, with 325 being the number of total time steps. The time steps cover the needed range for correlogram calculation.

What to turn in

1. 1-2 page summary report
2. Correlogram plots (similar to Fig. 2 of the paper) and pitch frequencies
3. Your source program