Peakdet2 Instructions Manual

Goal

The goal of the MatLab script Peakdet2 is to help researchers to identify the onset and offset of voicing on the glottal waveform signal (EGG) recorded by means of a glottograph. Peakdet2 identifies the voicing onset time at the first positive peak of the first derivative of the glottal waveform (DEGG) which corresponds to the instant of glottal closure immediately before the vocal folds start vibrating. The identification of the voicing offset time is less clear in cases where the EGG signal exhibits low amplitude symmetrical oscillations and no DEGG closing peak, e.g., as for voicing into closure in sequences such as /ab/ or /ag/. In these circumstances, the most consistent criterion is to equate voicing offset with the last glottal cycle which is associated with a well-defined (whether high or low amplitude) DEGG peak rather than with the last symmetrical oscillation.

Importing the data

After you enter MatLab, type "peakdet2". You will then be asked for a .wav file containing synchronized EGG and acoustic waveforms. After clicking on this file, peakdet2 will ask for a .txt file containing temporal information about the waveform portions that you intend to analyze. Look for the .txt file and click on it. This file should include the starting and end points of each analysis portion arranged in two different columns, as illustrated below. This sample file has 8 analysis segments, its first segment starting 420 ms after the beginning of the file and ending 620 ms after this same temporal point. (Important: the .wav and the .txt files should have different names).

1	420	620
2	960	1145
3	2940	3125
4	4660	4790
5	5200	5450
6	9350	9555
7	10020	10240
8	13920	14035

Analysis parameters

Assign a value to the following parameters on the main MatLab window:

(a) *"Enter the item that you want to analyze"*, as for items 1 through 8 listed above. Once the speech file segment number has been selected, an « EGG preview of item n» window will appear displaying the EGG waveform for that portion. In order to check the characteristics and noisiness level of the individual glottal peaks, it is a good idea to amplify the EGG signal appearing on the preview window using the magnifying glass placed at the window bar.

(b) *"In case of multiple closing peaks, the value selected in peak detection, can correspond to: the highest peak (enter 0), the first peak (enter 1), the last peak (enter 2), a value in-between (barycentre method; enter 3), none of them (exclude from calculation; enter 4)"*. Option 3 is recommended, especially for noisy peaks.

(c) *"The detection of double peaks requires an F0 ceiling. Which value do you propose for this ceiling? (i.e. a value slightly above the maximum plausible F0 that could be produced by the speaker). Recommended value: 500 Hz"*. Type "500 Hz".

(d) *"Number of points for DEGG smoothing (0: no smoothing, 1: 1 point to the right and left, etc). Recommended value: 1; for noisy signals: up to 3"*. High smoothing is definitely needed for the analysis of noisy EGG signals.

(e) *"Put markers. Only in the first and last valid peaks (enter 0). In all valid peaks (enter 1)"*. Option 1 should be chosen if the onset and offset pulses of interest are not the first and last pulses of the selected speech portion, e.g., in case that we want to measure the V1 voicing offset time at about /p/ closure onset and the V2 voicing onset time after the /t/ burst in the sequence /apta/. Option 0 would apply if we wish to identify the first glottal pulse of V1=/a/ and the last glottal pulse of V2=/a/ in the same sequence /apta/.

Graphic displays

Two windows are displayed next. The "Fig. 1" window shows the F0 and Oq (open quotient) values for the signal portion subject to analysis. The "Fig. 2" window shows the acoustic waveform and the spectrogram, as well as the glottal waveform and its first derivative. In the EGG and DEGG signals, red marks appear superimposed on all glottal pulses or just on the first and last pulses depending on the option chosen in **(e)** above. The two green cursors on the Figure 2 window may be dragged with the mouse and placed on any pair of red marks for taking temporal measurements. Temporal values for each cursor and for the distance between both cursors are shown at the bottom of the window.

Commands at the menu bar allow the user to listen to the entire file or to its displayed or selected portions, to zoom a selected portion, and to change the number of samples of the spectrogram. The spectrogram may be removed by setting the spectrogram command to OFF.

Modification of the results

A few more peakdet2 questions are formulated in the main MatLab window.

(a) *"Do you wish to modify the results?"*. If "y" (yes) is typed, the following message follows:

" -If all the Fo values are correct, type 0 (zero).
- The red lines on figures 2 and 3 indicate the first and last detected periods. If some of the periods went undetected, or extra periods were erroneously detected, enter 1 (one). You will then be asked to change the values of some of the settings.
- If you wish to correct some of the F0 values, enter 2.
- If the coefficient is correct but the initial/final period(s) must be suppressed, enter 3".
Option 1 allows changing the EGG threshold such that additional low amplitude DEGG peaks can be identified by the program (e.g., towards the offset of the voicing signal).

(b) *"If too many periods were detected, you may change the threshold for maximum F0. The present threshold is: 500. New value for the threshold (in Hz):"*. Enter 500.

(c) *"If too few periods were detected, you may change the threshold for peak detection. The present threshold is:*
- Enter a new value (absolute value; refer to figure to choose) for the threshold.
- Press RETURN to leave threshold unchanged.
- Type 0 in case the syllable needs to be analyzed as several distinct portions, i.e. if the discrepancy in peak amplitude is such that no setting gives satisfactory result for the entire syllable."

The reported threshold value in the second line (e.g., 0.0259 (25%)) corresponds to 25% of the highest positive peak of the dEGG signal. In order for peakdet2 to insert red marks on lower amplitude peaks, a lower value than the one above should be typed. The best way to proceed is to try different new threshold values and to check whether additional red marks have ben inserted on the DEGG signal or not.

(d) "*Do you wish to repeat the experiment, for this item? (y/n)*"
Once a new threshold value has been entered, the same token needs to be reanalyzed so as to verify whether the new choice of parameters works successfully. Type "y".

Saving the results. Going into the next token
After the second analysis, peakdet2 will ask again whether you wish to modify the results and to repeat the experiment fo the same item. If you want to carry out a new analysis type "y". Otherwise, type "n".

The results may be saved in a MatLab or text file by typing "y" to the question "*Do you wish to save the results, for this item*?". Results for successive portions of the file are saved in separate files automatically (e.g., results1.txt, results2.txt, etc.). They look as in the table reproduced below, where SimPeak1 stands for the closing-peak time in seconds, SimPeak2 for the closing-peak time of the next closure in seconds, F0 for the fundamental frequency calculated for each closure, SimPeak3 for the closing-peak amplitude, Oq for the open quotient using detection by maxima on the unsmoothed DEGG signal, DEOPAS for the amplitude of the minimum opening-peak in each closure, OqS for the open quotient using detection by maxima on smoothed DEGG signal,Oqval for the open quotient using the method listed above on unsmoothed DEGG signal, and OqvalS for the open quotient using the method method listed above on smoothed DEGG signal.

EGG = epgtrial2.WAV
ITEM = 3
BEGINNING = 10680.00 ms
END = 10870.00 ms
MULTIPLE CLOSING PEAKS SELECTION = Baricentre method
CEILING FREQUENCY USED = 500.00
PEAK DETECTION THRESHOLD = 0.21
SMOOTHING = 1
DATAFILE

#	SimPeak1	SimPeak2	F0	SimPeak3	Oq	DEOPAS	OqS	Oqval	OqvalS
1	0.0034	0.0095	163.7552	0.0296	67.6471	-0.0177	69.1176	74.3915	69.7379
2	0.0095	0.0156	163.5817	0.0294	67.1642	-0.0171	67.1642	72.3800	72.3800
3	0.0156	0.0223	150.0739	0.0341	70.2703	-0.0175	68.9189	74.1846	71.4985
4	0.0223	0.0282	167.8961	0.0235	69.2308	-0.0143	64.6154	69.1024	70.3850
5	0.0282	0.0347	154.7086	0.0270	61.9718	-0.0164	60.5634	61.8100	59.2025
6	0.0347	0.0414	148.3595	0.0246	61.3333	-0.0165	60.0000	60.9514	60.9514
7	0.0414	0.0482	148.2129	0.0255	60.8108	-0.0169	60.8108	59.4595	59.4595
8	0.0482	0.0547	153.0841	0.0240	61.1111	-0.0175	59.7222	62.2404	58.5064
9	0.0547	0.0616	145.4712	0.0273	57.8947	-0.0161	59.2105	56.5789	58.4522
10	0.0616	0.0683	149.9648	0.0288	58.9041	-0.0175	58.9041	57.5342	57.5342
11	0.0683	0.0750	147.6069	0.0287	56.0000	-0.0173	57.3333	54.6667	54.6667
12	0.0750	0.0819	144.9239	0.0286	56.5789	-0.0176	56.5789	55.2632	55.2632

Printing and exiting MatLab
The window graphs may be saved as an image with a .bmp or .jpg extension, and printed out. Type control <C> to exit 'peakdet2'.