EE 513 HW6

Matt Ruffner

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1 Problem 6.1

In this homework, the the provided `lpcex.m` file was utilized and modified to estimate vocal tract length based on the formant frequencies of a recorded open vowel sound. Due to background noise already present in the recordings I made, two vocal tract calculations, based on two separate pronunciations of the 'o' vowel, were averaged. The average vocal tract length calculated from `ooo1.wav` and `ooo2.wav` was 25.4cm.

A recording of the same speaker was then filtered with all-pole and all-zero filters generated by the formants from the open vowel Linear Predictive Code (LPC) coefficients. In addition to using both types of filters, -10dB of white was added to the recording to help simulate a noisy recording environment. I did my recording in the library, so there was a fair amount of background noise already. The output of the all-zero filter is much noisier than that of the all-pole filter.

The provided `aaa3.wav` was used to reinforce the findings that the all-pole filter reduced high frequency noise most effectively.

Moving the poles and zeros of the LPC roots farther away from the unit circle 'softens' the sound. When shifted to 0.3, it makes high frequency background noise somewhat more audible in the `ooo2.wav` recording, but is less twangy than when the roots are shifted to 0.9 for example. When the roots are close to the unit circle it has more of a square wave 'buzz' to it.

To process the data, white noise addition was just added to the beginning of the `lpctasts.m` file. To analyze multiple runs at varying root magnitudes, the data was written to a `.wav` file at the end of processing.

2 MATLAB Changes

To add -10dB of white noise to the input signal:

```
% add -10 db of white noise
noi=randn(size(y,1),1).*.1;
y=y+noi;
```

To save the results to a file for further listening:

```
audiowrite(strcat('poleshift',num2str(pmagshift),'.wav'),ytemp,fs)
```