Assigned: Tuesday 2001-02-27 Due: Tuesday 2001-03-06

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Background reading:

Read chapters 30 and 35 in Gold & Morgan.

Reading assignment:

"Musical Instrument Recognition Using Cepstral Coefficients and Temporal Features", A. Eronen & A. Klapuri, Proc. ICASSP 2000. This gives you an introduction into how instrument identification is addressed and the kinds of features that are used. Add a summary to your web page, including any questions or aspects you found particularly interesting.

http://www.ee.columbia.edu/~dpwe/courses/e6820-2001-01/papers/EroK2000-inst.pdf

Practical assignment:

In this week's practical you will generate your own sinewave replicas of natural speech by using LPC analysis to track formants. The provided function `lpcfit.m` will perform short-time LPC analysis of a given signal (see the usage example in this week's Matlab diary); each row of the resulting matrix is of the form `[G a1 a2 ... ap]` where `G` is the overall gain of that frame (128 samples by default) and `[1 a1 a2 ... ap]` defines the denominator of the all-pole filter. The following code converts such a row into a set of approximate frequencies and magnitudes (assuming an 8kHz sampling rate):

```
G = arow(1);
poles = roots([1 arow(2:p)]);
freqs = angle(poles')*4000/pi;
mags = G ./ (1 - abs(poles'));
```

Write a program to convert the matrix of LPC rows returned by `lpcfit.m` into two matrices, one containing the frequencies of the lowest 3 poles (sorted in frequency, ignoring poles with zero or negative frequency - see `help sort`, `help gt` and `help find`) and the second containing the corresponding magnitudes. Resynthesize sinewave replicas based on these matrices with the provided `synthtrax.m` i.e.

```
sws = synthtrax(frqmatrix', magmatrix', 8000, 128);
soundsc(sws);
```

(`synthtrax.m` also needs `slinterp.m`). Compare the spectrograms of original and resynthesis to check that it is working. How does the reconstruction sound?

Problems:

From the chapter-end exercises in Gold and Morgan: problems 19.6, 20.2, 21.2, 29.5.

Project:

Be sure to send me an email this week describing your project, or pointing me to the description on your web site.