COS/MUS 314

Spectral madness!
Assignment due 29 April 2009

0. Reading:

Unit analyzers in ChucK
http://chuck.cs.princeton.edu/doc/language/uana.html
FFT Cheat Sheet
http://www.cs.princeton.edu/~fiebrink/314/2009/week12/FFT_handout.pdf

1. Written question: Using the STFT (2.5 points)

In practice, describe why you would want to…

a. Use a smaller or larger FFT size
b. Use a smaller or larger window size
c. Use a smaller or larger hop size
d. Perform calculations on an FFT spectrum instead of audio samples

2. Written question: Spectral properties (2.5 points)

Consider taking an FFT of the sound, transforming the spectrum in some way, then taking an IFFT of the transformed spectrum and playing it back.

Based on your knowledge of the FFT and IFFT (and perhaps some experimentation in ChucK), what are the effects of executing the following transformations of the spectrum? Describe what happens to the sound as best you can, qualitatively and quantitatively.

a. Halving the values in all bins
b. Doubling the values in the bins above 500Hz
c. Shifting the spectrum up by 10 bins (e.g., bin 123's value is assigned to bin 133) (Think VERY carefully!)
d. Setting all bins to be equal values
e. Multiplying all bins below 300Hz and above 600Hz by 0, and leaving the rest unchanged.

Bonus (1 point):

f. Multiplying the n-th bin by the function sin(2*pi*1/(2N)*n), where N is the number of bins, for all n.
g. What is the relationship of parts e and f above to *filters*?

3. Creative coding (5 points)

Take a look at the code that Perry and Rebecca demoed in class. Steal freely from it. Pick one or more features (at least one has to be something other than FFT spectrum) that capture some interesting aspect of the sound. Extract it in real-time from the adc.

Now do something COOL with it! (e.g., use it to drive some synthesis parameter, the structure of your piece, LiSa parameters, etc.)

Need some ideas? Detect onsets, follow pitch, vowel or loudness, ….

Written part: In a few sentences, describe why you picked the feature(s) you did, and how you used it/them.

What to hand in:

- Your written responses to questions 1 and 2
- Your code and written response for question 3.