EE6641 Analysis and Synthesis of Audio Signals

Hw2 : Time-warping and frequency shifting based on sinusoidal modeling

Due Nov. 24, 2015

Brought to you by Yi-Wen Liu

Objectives: In this lab, you are asked to implement sinusoidal analysis and synthesis in several pieces of MATLAB scripts. After implementing the tasks properly, you should be able to do time-expansion or pitch-shifting, which is popular in signal processing.

Tasking description:

1. You are given 3 Matlab scripts to start with. The first is the main script. Besides parameters assignments, you will also encounter wave analysis and wave synthesis. When executing the main script, you are asked to input 3 arguments, the first is the time expansion factor, and the second is the number of semitones that shifts the pitch. The last one is the number of trajectories to track. The number of trajectories will directly influence the synthesized sound.

2. In the initial step, you can choose one of the 4 default wave files to be synthesized. You are welcomed to use your own wave sound.

3. In wave analysis step, you will need to utilize findpeaks_starter(). In that case, you are asked to implement this function. The input arguments are frequency component of one frame and the number of peaks to be extracted. The outputs are the frequencies found by you in ascending order and the corresponded amplitudes in dB. Note that you may need sortrows() and quadratic interpolation to do this task.

4. Another function that you are asked to implement is additivesynth_starter(). This function should take a list of the amplitude, frequency (amplitude in dB and frequency in rad/sample) and initial phase of sinusoidal components and calculate a frame of the output signal which is the sum of sinusoidal components.

5. After finishing the two functions, you should be able to synthesize sound with different number of trajectories, speed, or pitch.

6. Compare the synthesized sound and the original sound. What are the differences? Why?

7. Sinusoidal model can be used in different areas. Can you describe some applications that you think are feasible to make use of this model?

Things to turn in on LMS:

Please find a group with 2 people. One of you should turn in all of your code and a 正式報告 in PDF format. The report may include the answers to the questions above and some figures.