IERG 4190 Mini Project 1
Analysis of Music Pitches

Prof. Dahua Lin

Due: Oct 9

1   Overview

Pitch is a major auditory attribute of musical tones, characterized by the perceptual *frequency* of the oscillations. In this project, you would be required to write a simple program to compute the principal frequencies of several musical notes, given a short music track.

The provided music track is comprised of 15 chunks, each corresponding to a particular music note. In particular, the music notes are presented in the following order:

$$C_4, D_4, E_4, F_4, G_4, A_4, B_4, C_5, B_4, A_4, G_4, F_4, E_4, D_4, C_4$$

To complete the analysis, three major steps need to be done:

1. **Load the wave file**. In computer, a common file format to store an audio signal is the *Waveform Audio File Format*, which is often referred to as the `WAV` file. We provide a file named `cnotes.wav` for this project. The scipy package has a module scipy.io, which provides functionalities to read an audio signal from a wav file.

2. **Delimit the chunks**. As mentioned, the audio signal is comprised of multiple chunks, as shown below. Hence, one will have to first find the boundaries of these chunks, and extract individual chunks for analysis.
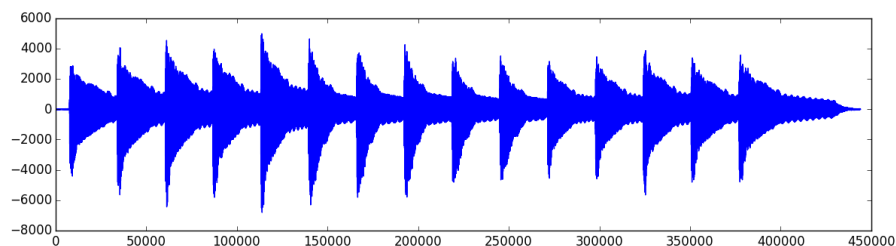
3. **Compute principal frequency**. For each extracted chunk, one may compute the *principal frequency*. A music note may be comprised of multiple frequency components, and one of the components has the largest magnitude, which we consider as the *principal frequency*. The goal of this project is to compute this frequency for each music note presented in the file.

2 Programming

You are required to write the program in `Python`. In particular, we provide a code skeleton `analyze_wave.py`. In this file, we already provided the main function `analyze_wave`. What you are required to do is to fill in the implementation of three core functions:

- `load_wave`: load an audio signal from a given wave file.

- `find_note_begins`: find the beginning index of each chunk.

- `compute_principal_freq`: compute the principal frequency of a given chunk.

Please refer to the code skeleton for detailed specification of these functions. After all these functions are implemented, you can run the script by typing the following statement in your shell: `python analyze_wave.py`. This program would present the results in two ways:

1. Show the results the console, which list both the beginning location and the principal frequency of each extracted note.

2. Produce a plot as follows, where the red marker of shape `+` indicates the beginning of a chunk.
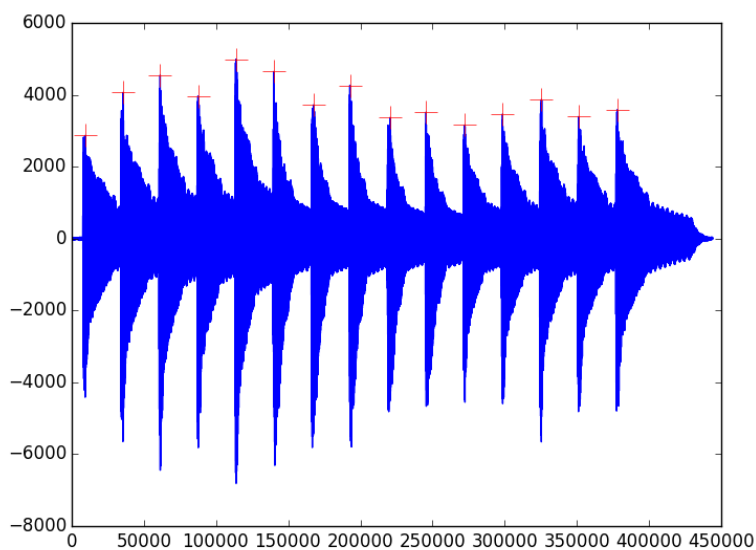
3 Submission

Please send your finished source code to the tutor by email before **Oct 10**.