Assignment 2 & 3

Music, Mind & Technology

Release Date: 21/03/24
Deadline: 05/04/24

Question A

1. Harmonics
    a. Create the Baby Shark melody using sine tones with the first 10 harmonics (link: timestamps 0:24 to 0:33). The notes needed for the rhyme are:
        D (293.5 Hz), E (329.5 Hz), and G (392 Hz)
    b. Create two versions of the melody, one with the odd harmonics (3, 5, and 7) and another with the even harmonics (2, 4, and 6)
    c. What are the perceptual differences between all 3 versions
2. Virtual Pitch
    a. Use the melody created in part 1a.
    b. Remove the fundamentals to create the same melody with virtual pitch
    c. Remove the first harmonics to form another melody
    d. What is the perceptual difference between all 3 melodies

Question B

You are allowed to use either Librosa or MIRToolbox for the following questions:

1. Rhythm & Meter

Aims: To get familiar with tempo estimation from audio using the MIRtoolbox. To assess the performance of the tempo estimation method.

Part 1.

- Read the sample music ‘michael_jackson.mp3’, ‘dream_theater.mp3’, ‘mozart.mp3’, ‘queen.mp3’ and ‘taylor_swift.mp3’ using the miraudio command. Estimate the tempos of the files in the folder. For this, go to the URL http://www.metronomeonline.com/ where you can find an online metronome.
- Play each excerpt using the mirplay command
    Eg: mirplay(‘queen.mp3’);
- Adjust the speed of the metronome to match with the tempo of the music. Write down each tempo. If the tempo varies within the excerpt, try to estimate the range of tempi within the excerpt.

Part 2.

- Use the function mirtempo to computationally estimate the tempi of the excerpts.
- Compare the computational estimates with your perceptual estimates.
- To what extent do they agree? What are the typical discrepancies? Can you explain the reason for them?

Part 3.

- Find out which samples have variable tempi. Use frame-based tempo analysis to estimate the time course of development tempo.
- To this end, decompose the samples with variable tempi using the 'Frame' option of mirtempo (see help mirtempo; use a frame length of at least 2 s).
- What are the ranges of variation of tempi? Do they correspond to your estimates?

2. Repetition in Music

Assume *x* = Rollnumber % 7

- First analyze the song '*x*.wav' from the data folder.
- Extract the chromagram vectors of this excerpt frame by frame, using the mirchromagram operator and the 'Frame' keyword.
- Compute the similarity matrix of the sequence of chromagram, using the mirsimatrix operator.
- Look at the results in the figure representing the similarity matrix. Try to understand the link between the lines in the similarity matrix and the checkered rectangles.
- Try to see the impact of any change of the different parameters of the model in the final results. You can change for instance:
    - the audio feature (chromagram, mfcc, and spectrum)
    - the frame length and hop factor,
- Which of the features best represents your notion of perceptual segmentation and repetition?
- Try the same kind of analysis on all files provided in the samples folders.

General Instructions

- The MMT_MIR_Demo.pdf contains descriptions of some important functions in mirtoolbox
- Plagiarism is strictly prohibited.
- Cite all external sources used in your answers
- **No extensions will be given**