BLG354E
Homework-2

10.04.2019

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I'm still cowering in the rover, but I've had time to think. And I know how to deal with the hydrogen. (...) Commander Lewis was the last one to use this rover. She was scheduled to use it again on Sol 7, but she went home instead. Her personal travel kit's still in the back. Rifling through it, I found a protein bar and a personal USB, probably full of music to listen to on the drive.
Time to chow down and see what the good commander brought along for music.
Disco. God damn it, Lewis.

Andy Weir, The Martian

- You should write all your code in Python language.
- Cheating is highly discouraged.
- Ninova only stores files under 25 MB. If you could not upload your results, you can share them with me via Dropbox.

1 - Part 1: "Change My Pitch Up!" (30 pts.)

In this part of the homework, to tune a previously saved guitar record, you will change the pitch value of it. The website by François Grondin [1] gives the best details and an example implementation on MATLAB. You can use the the example audios given with the homework. However, if your taste of music doesn't match with mine, you can download the trial version of Guitar Pro 7 [2], obtain new tabs from your favourite songs from Ultimate-Guitar [3] and export them as audio as given in Figure 1. Uploading only one of the result audio files is adequate. In your report, you should mention about the implementation details and how to run the code.

[1] http://www.guitarpitchshiftercom/
[2] https://www.guitar-pro.com/en/index.php
[3] https://www.ultimate-guitar.com/explore

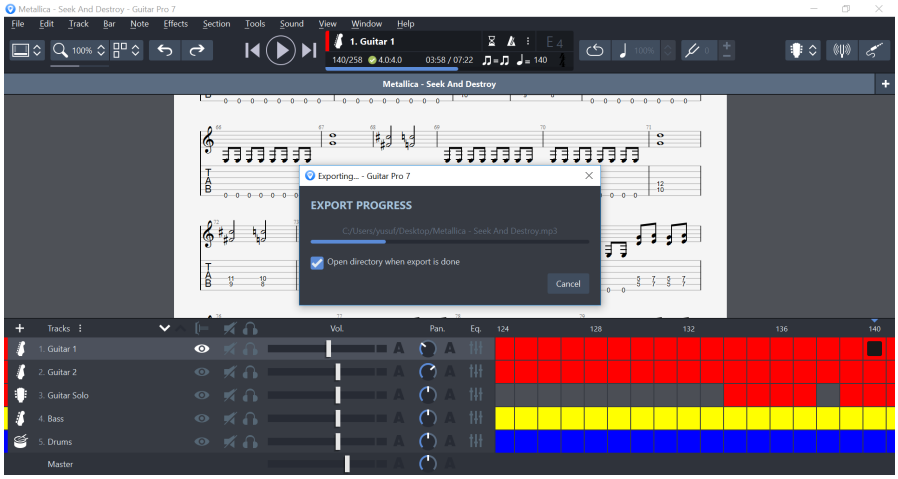


Figure 1: Exporting a song in Guitar Pro by File→Export→ Audio

2 - Part 2: "I'm giving you a NIGHTCORE to tell you how I feel" (10 pts.)

Nightcore is a relatively new music genre where pitch of an original song is changed absurdly and its speed is increased by a value of %20-%30. This speed change can be done by linear interpolation.

Write the Python code which creates a Nightcore version of a given song.

For this part of the homework, you can use an original song or one of the songs from Part 1. In your report, explain how you did the increment in speed.

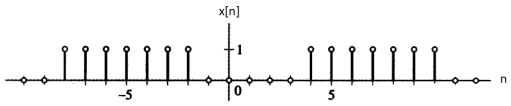
3 - Part 3: "Hey Mr. DJ, come down and play" (30 pts)

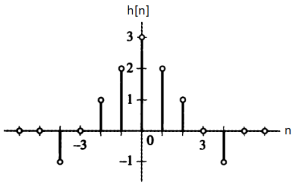
There are four other audio files given with the homework. Let "input.wav" be an input audio given to a system. Use "h1.wav", "h2.wav" and "h3.wav" as impulse responses of that system and obtain alternated audios "y1.wav", "y2.wav" and "y3.wav" using DT convolution. Instead of using ready-to-use functions, you must calculate the convolution results by your own coding.

4 - Part 4: "Slide to the left, slide to the right" (30 pts.)

Evaluate the convolution of the following systems.

- $x[n] = (u[n+10] - 2u[n] + u[n-4])$
  $h[n] = cos(\pi/3n)$





- $$x[n] = \begin{cases} 0, & n < 0 \\ 2\alpha^{n+2}\dfrac{1-(\alpha)^{-1-n}}{1-\alpha^{-1}}, & 0 \le n \le 10 \\ 2\alpha^{12}\dfrac{1-(\alpha)^{-11}}{1-\alpha^{-1}}, & 11 \le n \le 13 \\ 2\alpha^{12}\dfrac{1-(\alpha)^{n-24}}{1-\alpha^{-1}}, & 14 \le n \le 23 \\ 0, & n \le 24 \end{cases}$$

$$h[n] = \begin{cases} 0, & n < -1 \\ -(n+2), & -1 \le n \le 1 \\ n-4, & 2 \le n \le 4 \\ 0, & 5 \le n \le 9 \\ n-9, & 10 \le n \le 11 \\ 15-n, & 12 \le n \le 14 \\ 0, & n > 14 \end{cases}$$