IG 2407 – Data Acquisition and Processing

Project Assignment

Project objectives

The project objectives are:

1) To transcript the music notes from some audio input recording,
2) To watermark the audio input with some text info, in an inaudible manner (inaudible in this case meaning that the SNR of the watermarked file is greater than 30 dB).

Prerequisites

Before proceeding, it is important to know some relations between the musical notes and the involved frequencies. Basically, all the sounds we hear have frequencies ranging from 20 Hz to 20 kHz and the musical notes are just a specific set of frequencies within this region.

To better understand the frequency notes correspondence for a piano, see Figure 1. Also, a detailed frequency-note-wavelength correspondence can be found at: http://liutaiomottola.com/formulae/freqtab.htm .

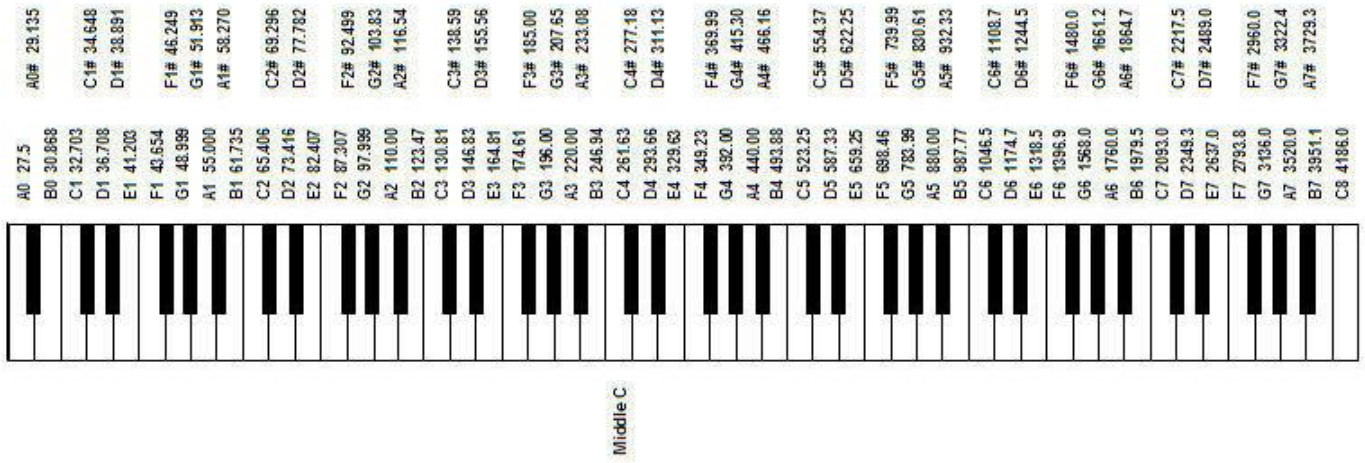

Fig. 1: Key-frequency correspondence for a piano.

Project description

This experiment aims to transcript piano music at the basic level. That is, one note is played at a certain time. The piano audio samples used within the project come from a real source (piano recording), therefore the audio file itself is not perfectly sound in tune. Some of the problems needed to solve are overtone analysis, noise reduction and frequency separation.

In this project, Fast Fourier Transform (spectrogram) or wavelet analysis (scalogram) should be used for time-frequency analysis (a good explanation of these two analysis methods can be found at: http://mudasir.hubpages.com/hub/wavelets1).

For example, using Matlab, you will be able to create a spectrogram/scalogram of the audio signal. HINT: you may need to perform low-pass filtering before the time-frequency analysis.

You will need to write algorithms for frequency quantization and de-noising, and finally plot the extracted notes against their duration. In Figure 2 you have an example of such transcription obtained for the sample audio file *piano.wav.*

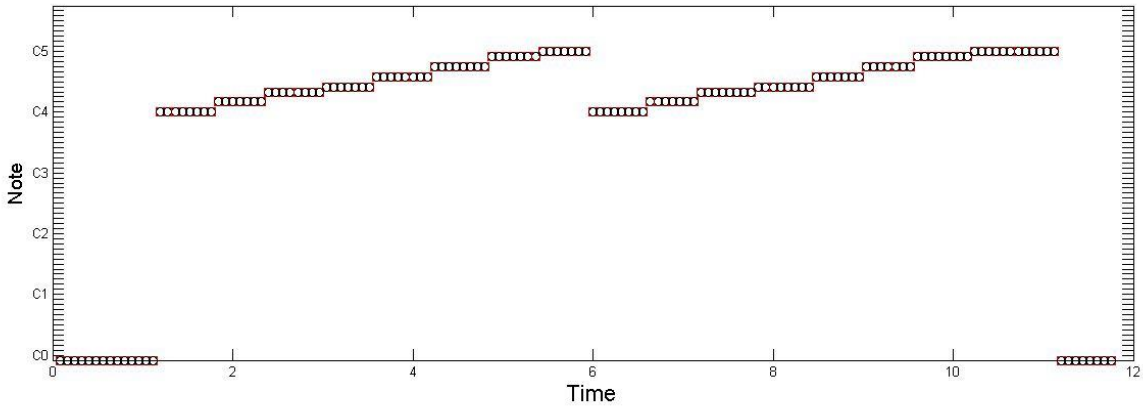

Fig. 2: Note/time transcription obtained for the audio file "Piano.wav".

Once the notes are extracted, propose a method of inaudibly inserting a text message (for example, the names of the project developers) within the wav file. Therefore, in this part you are requested to perform the watermarking (either by LBS, or frequency-based) of your assigned wav file. Finally, estimate the SNR after the watermarking and propose some directions for improving it [1,2].

Deliverables: deadline Friday, May 31st 2019

The project evaluation/marks are based on the following deliverables:

1. The source code performing the transcription of notes, audio watermarking and SNR evaluation.
2. The report containing an introduction, a detailed explanation and justification of the method used, an evaluation of the results, a conclusion and some related references.
3. The pdf/ppt project presentation slides. The project presentation will be accompanied by a demonstration at the defense (transcript and watermarking of an audio file). The presentation of the project will be on Monday 27th of May, each presentation will last 10 min (maximum 5 slides!!! per presentation).

The deliverables should be sent to

- ali.dziri@cnam.fr for group 1
- hmaied.shaiek@cnam.fr for group 2

Bibliography

[1] http://jultika.oulu.fi/files/isbn9514273842.pdf
[2] https://pdfs.semanticscholar.org/635a/d12c5e0bbb2f956360e4d0be3e7e5a45be67.pdf