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Synth challenge 2022

Sound of car and Barcarolle

Abstract

Sound synthesis allows us to create sounds from computer programs. It can be used to recreate everyday sounds (like musical instruments) or imagine new sounds, for example, for electronic devices. The goal of this challenge is to synthetize music and technologic sounds. The first challenge consists in recreating the sound of an electric car. The second concerns a music composition, that we will synthetize, using MIDI file. Python is used for the first topic, Matlab for the second. The results are presented as audio files.

1 Introduction

This challenge is divided in two parts. The first consists in figuring out how the electric car "Superb" by Škoda sounds, and synthetize it. The second consern a part of "The Tales of Hoffmann" by Offenbach, "Barcarolle". We will use the MIDI file of this music to recreate the sound of the instruments. The goal of these synthesis is to try to create or recreate sounds that could be as close as possible to real life sounds.

We will first explain the methods that allowed us to carry out this challenge. Then the resuls will be exposed in the next part and discussed in the conclusion.

2   Method

2.1   Sound of car

For this challenge, we used Python as programing language. The first step was loading the data of the car, which are stocked in a table, where the 1st column correspond to the time and the other to the parameters of the car variating depend on time. Reagarding the speed of the car, we consider the 9th column of the table.

Then, in a loop, we generate a sinewave, where the frequency depends on how the speed variates. If the speed increases, the frequency change to a higher one, and if speed decreases, the frequency is lower. After this loop, we write mp4 sound file playing the frequency variating sinus depending on the time. With this, we obtain a sound variating with the speed, but it's not enough to make it sound like a car. Therefore we add another sinus which comes to modulate the previous sinus. Finally, we adjust his frequency and the frequency range of the first signal, in order to reach a sound as close as possible to a car sound.

2.2   Barcarolle

For this challenge, we used Matlab as programing language, we also have some files aleread filled to help us reading MIDI files. These kinds of files are divided into multiple channels, where we can find which instrument should be played. With an other Matlab file, we create a function permetting to define how the chosen instruments sound, the function check with an "if" loop which channel is being read and a mathematic function (depending on the instrument) recreate the timbre of the instrument. To recreate the grup of violin, we use a formula for a single violin, that we repeat but we modify slightly the parameters to make it more realistic. We finally play the new version of Barcarolle with the instruments that we've synthetized.

3   Results

3.1   Sound of car

The result is avaiable in mp4 file. The quality of result is subjective because each person have a different perception of sound and different exectation about how an electric sports car should sound. So if we talking about our subjective point of view, I find that my sound is satisfying as a sound's car. If I compare to the video of the Superb given, it's pretty similar, but the original seems softer.

3.2   Barcarolle

The musis is composed of 2 types of instruments as expected. But the Grand Piano sounds a little bit like a percussion and the violin ensemble like flutes. However the effect of making several violin slighly differents work well.

4   Conclusion

In this challenge we have tried to apply sound synthesis. Even if the applications are different, the principe is the same : use mathematic formulas to represent the timber of the sound. In the first challenge we used frequency modulation to represent how an electric car sound variates with his speed. We could have further improved our result by doing other modulations, add other sinus modulated in frequency or tried amplitude or phase modulation. We also could have add filter, to highlight low or high frequencies.

In the second challenge we've tried to use MIDI file to make a synthesis of a music instrument. We used different formulas to synthetize the piano and the grup of violin. Maybe the parameters were not very well defines because the result is not really satisfying but it approximately works. This synhetization could be improve if we change the parameters, we also can add more violins to being more realistic.