Hi, everyone. This is team 65. I am Haocong and this is Sifan. Please allow us to provide some brief introduction to our capstone project.

So, our project is music sheet maker or music transcription. Our advisor is professor Chen and her PhD student Yilin.

So for this project, our program can write music sheet automatically with a given part of the audio. We created a web application for it. And our music sheet is written in tablature.

…(motivation)

This is how our program works. First we play a short piano audio and let the program record it into a wav file. Then we will fetch the data of the audio and start analyzing it. The data is in time-frequency domain. After that, we will create a MIDI file for the short audio based on the data we get. And the MIDI can be read by the computer as the music sheet.

So, let’s talk about our approaches. We all know that there are different notes in a music sheet. Different notes represent different pitches and different pitches represent different frequencies. So what we are going to do is to analyze the frequency. In our program, we recognize the pitch of each note based on the frequency and how long this note lasts. In music sheet, these are the two basic elements, pitch and time. And with these two elements, we are able to create the MIDI file.

…(algorithm)

So, what is MIDI? MIDI is the abbreviation of Musical Instrument Digital Interface. It is a technical standard that describes a communications protocol, digital interface, and electrical connectors that connect a wide variety of electronic musical instruments, computers, and related audio devices for playing, editing and recording music. In another word, it is the music sheet that can be read and understood by the computer.

Creating MIDI is the final step of our project. There are already existing methods to write MIDI, but most of them require users to write it by hand, which means label the pitch and time of each note one by one. And in our project, our program will do the label work automatically. We already extracted the two matrix containing the time and frequency information of the audio, then we can use them directly to create the MIDI.

In our program, each pitch has its own serial number. And with the frequency vector, we can label each note with a number, which will be used to create the MIDI. And the same thing go with the time. With the time vector, we know how long each note lasts. And combine them together, we can create the MIDI.

These are two examples of the MIDI we created. The second one is the one we recorded in our video. It is actually a theme song of a video game. In most cases, our program works well, but there are errors sometimes. Most of them are octave errors, such as C4, which is known as the middle c. Our program sometimes recognizes it as C5, one octave higher than the C4. There are also mistakes between two notes that are very close to each other. This is because the frequencies of two nearby notes are quite similar, so sometimes errors happen.

We also list the future development here. First, we need to make the system more accurate and can deal with more complicated music. As I just mentioned, there are errors sometimes. And right now, our program cannot deal with fast music. We need to play it slowly in order for our project to recognize the pitch accurately. And our project can only write MIDI for monophonic music. The real music is much complicated than this, so this is something we need to approve (和弦chord). The second and third part, recognize human voice and different musical instruments, were actually in our original plan, but in the end, we find that it is not possible for a two members-team to finish all this, so that’s why our project is a semi-finished product.

…(demo)

That’s all, thank you for your patience. If you have any question, please contact us via email.