Phong Pham

CS591 Computational Audio

May 1st, 2016

**Tempo Analysis – Is it the same? What makes it different?**

**Abstract**

The purpose of this project is to determine the difference in tempos between various song genres as well as seeing if there is a similar trend in different languages. However, this is only done on the pop genre. I also take a look at how the tempo changes in different performances of the song. This is done in comparison to the live version, the studio produced version, a cover (some singer singing the song), and an instrumental cover (a piano version of the song).

**Introduction and Algorithm**

The project is conducted by detecting energy-based onsets through the pieces to calculate the beat of a song at a predetermined window W. After calculating the onsets, the highest value is found by performing auto-correlation and finding the highest beat, relative to a threshold, which happens to be the highest peak found after performing auto-correlation. Once the peak is found it can then be stored along with the position at which it was found. Doing this allows the data to be plotted for easier comparison. I decided to only do various languages for one genre because it was a genre that I listened to regularly in Japanese, Korean, English, and occasionally Chinese. Comparisons are also done for various genres in English. The list includes Pop, Jazz, Classical, Blues, Country and Rock music. For the purpose of this project I used a non-overlapping sliding window size of 441000, this equates to 10 seconds of each piece per window.

**Analysis I – The difference found in genres**

Music is split into many genres because inherently they were categorized into specific genres for a reason, but how different are they really. Observing the graphs shows that Pop, Jazz, and Classical music start off in a similar manner. They do not have much sound played within first 10 seconds of their piece. Where as Blues, Country and Rock music start off in a similar manner. They have a noticeable amount of sound playing within the first 10 seconds of their respective piece. However interestingly enough, halfway through each piece, but the Jazz one, the beat is either decreasing or staying relatively low. Then towards the end of the pieces we find that the beat is decreasing, again all but for the Jazz piece. However, we need to note that the Pop, Country, and Blues music leave roughly 20-30 seconds at the end of their piece filled with silence. Pop, Rock, Classical, and Jazz music have a beat change 12 or 13 times throughout their piece (the beat drops and increases). Interestingly the Country song does this 17 times while a Blues song does this only 8 times.

This information shows us that these collective genres of music are similar to some degree. Although the beats are at different levels, the way in which they change throughout the song is similar. The most noticeable differences are found in the Jazz song and the Blues song when compared to each other. Pop music is interesting because it is typically enjoyed more so than other genres of music by the general populace. Since this is the case, how different are they across other languages?

**Analysis II – The difference across languages**

All languages live version of the song has a pause after the piece ends. This is probably due to how performances are done in the entertainment business. Also, they start at a relatively higher beat. This is possibly because the pieces either have the audience cheering or clapping at the start. The live and studio version of the Korean pop song end in a similar manner, there is an increase in the beat followed by a pause. This is likely due to the fact that Koreans actually play the music in the background during live concerts, but they do sing (possibly lip-sync) and dance during performances. The Japanese studio version has a very large spike in the beat before the song ends. I believe this is due to the fact that the song has music and singing still going on while the other pieces have some time with no sound at all towards the end.

Chinese Live, KR Live, and KR Studio have the beats increase/decrease 14 times total. English Studio, KR Piano, Japanese Live, and JP Studio have the beats increase/decrease 12 times total. JP Cover and CH Studio versions have the beats increase/decrease 21 times total. The EN Piano version only changes beats 10 times. The EN Live version changes 13 times. The KR Cover and CH Piano change beats 15 times, the JP Piano changes 17 times and the CH Cover changes 16 times. Beat changes are interesting because they change in different places throughout the music. These beat changes further show that KR Live and Studio versions are very similar for a reason. It’s also interesting to note that this case is also true for the respective JP versions. The JP Cover is very different. This is most likely because it is a different artist singing the piece and is not able to maintain the same beat. Oddly enough since the Piano versions are mostly synthetic (pieces are played using a program with the exception of the JP piece), the respective Piano versions of the pieces do not exactly match the studio versions. Also, the difference is possibly due to the limitations of the piano. Since, I do not think the piano can mimic the precise frequency produced by other instruments.

Other interesting things are the EN Studio version and the EN Cover are the only ones that start quietly around 0 BPM. The KR Piano does not use a pause at the end despite there being a pause in the original. CH (Studio, Live, and Piano), KR (Live, Piano, and Cover), JP (Studio, Live, and Piano), and EN Piano have the beat increasing roughly halfway through. The opposite is found for EN (Studio, Live, and Cover), CH Cover, JP Cover, and KR Studio. Interestingly the beat increasing midway through the piece occurs during most of the live pieces (with the exception of EN Live) as well as all of the piano pieces. I think this is again slightly due to the fact that it’s a piano cover and if the piece itself does not follow this trend.

**Conclusion / Afterthoughts**

In conclusion, I found that the different genres are somewhat similar, but I think the main songs that were different belonged to either Jazz or Blues. If I had more pieces of each genre for this portion then I could come to better conclusions. In respect to the different languages, I found that the language itself has little to no effect in the performance of their respective music with the exception of Korean Pop music. Also, the difference from the Live and Studio version across languages differs significantly only in the Chinese Pop song. The English Cover of the song is very similar to the original despite being the only version without the original song playing in the background (the artist plays the song on a guitar). Interestingly, the songs were produced and recorded at different times, which might account for some differences in the style of Pop music possibly throughout the years. If I had more time and music pieces then I would have liked to look into a few more languages or use more pieces to solidify the information I found. Also, if I had a better way of comparing the information (I was looking at 8 graphs at once) then I could possibly gather better observations.