

Improvement of a music identification algorithm for time indexing

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Abstract. In this paper, we propose the improvement of music identification algorithm. We use the fingerprinting algorithm. We research the previous music identification algorithm and found two open sources which are the WILLDREVO-dejavu and the Openfp. We compare the WILLDREVO-dejavu with the Openfp and select the open source of better performance to improve it. The comparison result is that the WILLDREVO-dejavu is better than the Openfp. The selected open source has the high recognition and the time indexing function. It takes a long time to search music. The time indexing function is to find the location of start of the music for the query music sample within 3sec. We improve WILLDREVO-dejavu through verifying DB process and the previous algorithm. In the experiment, we use the number of 25 music contents.

Keywords: music identification, fingerprint, time indexing

1 Introduction

Many people have heard music contents using cell phone and MP3 player etc. In addition, they upload and download music contents in the web site, P2P, BitTorrent and blog for sharing them. When we use music contents, we are approved to right holders to use music contents because these belong to them. However, many people are not approved to right holders [1].

To prevent the illegal sharing of copyright-protected digital contents in the internet, we use the music identification using the fingerprinting algorithm. We research the music identification open sources used the fingerprinting algorithm. We select two open sources the WILLDREVO-dejavu and the Openfp. The WILLDREVO-dejavu is based on linux operating system and python language and use the MySQL database and hash algorithm to identify the music contents [2]. The Openfp is also based on linux operating system and C language and use the band pass filter which is bark band, the binary quantization and MFCC [3].

For the WILLDREVO-dejavu and the Openfp, we compare one with the other and modify the algorithm better than the previous it. In the comparison result, we select the WILLDREVO-dejavu and improve it because it has the time indexing function. Existing algorithm is identified more than 3 seconds of the music and takes more than

one minute of time for one music file. We improve this point to revise the database process and the identification method.

This paper is divided into 4 sections. The section 1 explains the music identification for the WILLDREVO-dejavu and the Openfp. The section 2 represents the improvement of music identification method. The section 3 shows the experiment and the result. The section 4 is the conclusion.

2 Music Identification

The previous music identification methods are divided into two methods. First, the feature method used the chroma or the filter. The method using chroma makes the features for the melody of music. The method using the filter makes it for the specific part. These are very unique features for each of music [4]. Second, the perceptual hash method used hash algorithm has the inherent value for each of music.

2.1 WILLDREVO-dejavu open source

This open source uses spectrogram and selects the peak. Process method is as follows.

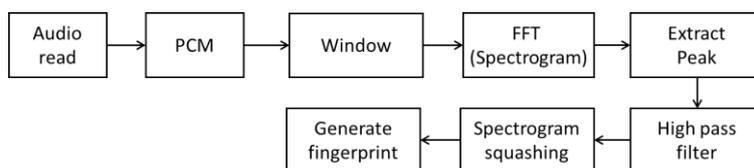


Fig. 1. WILLDREVO-dejavu process

In this open source, they read audio file and process PCM. They make spectrogram using FFT and sliding window method. In this process, they compose the number of 4096 sampling data in the sliding window and overlap 1/2. After spectrogram, they extract peak and use high pass filter to compose the robust peaks. The composed robust peaks have the value of time and frequency axis. They are generated as fingerprint using SHA-1 hash algorithm. The values of peaks and the distance among the peaks are composed to fingerprint. This algorithm can find the location of the start of music for the query music within 3sec.

2.2 Openfp

This open source use FFT, band pass filter and MFCC clustering method. Process method is as follows.

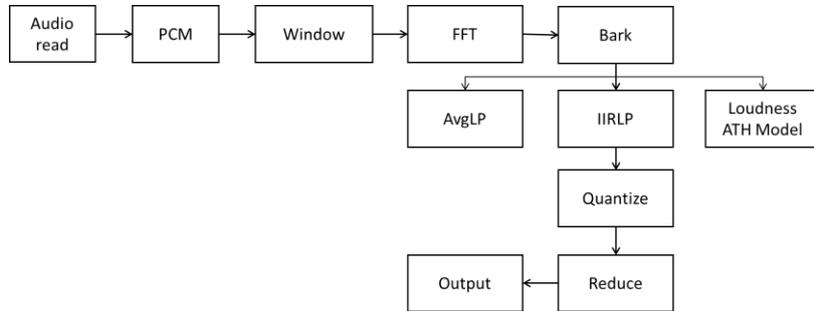


Fig. 2. Openfp Process

Openfp uses IIRLP which is the proper power band to reduce spectrum and noise. After the values of IIRLP, these quantize binary flag value to decrease output value. In this open source, they use MFCC clustering in the matching process to increase matching speed. MFCC clustering make feature vector composed clustered values.

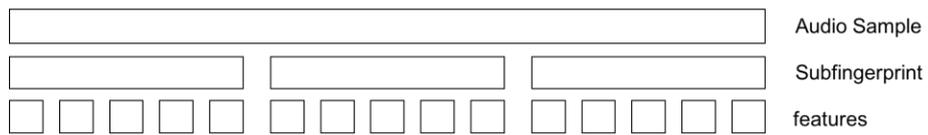


Fig. 3. Generate subfingerprints

The values of the extracted fingerprint are composed of 32bit subfingerprint sets. MFCC clustering is performed to features in a subfingerprint. In other words, each of subfingerprints has one of the feature vectors. The feature vectors generated MFCC primarily serves to reduce the search time in the matching process.

3 Improvement of music identification algorithm

The existing open source can identify music using more than 3seconds music file and take more than one minute of time for the number of one music file.

In this paper, we improve identification speed and make to identify music within 3seconds music file. We verify database structure, SQL query and music identification algorithm. The improvement of music identification algorithm process is as follows.

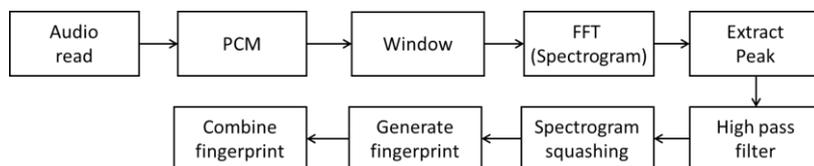


Fig. 4. Improvement algorithm process

In the process, we compose to the continuous fingerprint process. That can identify music because it is very unique and inform the location of the start of music. It can match continuously between the feature of music and the part of music. According to this characteristic, the continuously matched fingerprint has the robust characteristic for the time indexing.

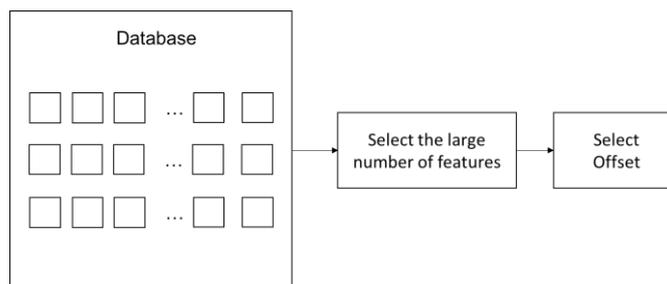


Fig. 5. Database composition

We use the continuous offset. As result, it improves the accuracy of the time indexing because the offset is the location information for the music.

4 Experiment result

We use the number of 25 music files. The experiment result is as follows.

Table 1. Experiment result

List	WILLDREVO-dejavu	Improvement algorithm	Openfp
Recognition ratio	1sec	80%	90%
	3sec	100%	100%
	5sec	100%	100%
Smallest units	1sec	1sec	5sec
Processing speed	About 70sec	About 3sec	About 1sec

The improvement algorithm is enhanced in part of 1sec music of the recognition ratio and reduced processing speed. We analyze open source algorithm made by python and rebuild program using Matlab [6].

5 Conclusion

In this paper, we study to improve music identification to use open source which is WILLDREVO-dejavu. We compare WILLDREVO-dejavu with Openfp and select to improve former open source because the former has the time indexing function.

Although we improve open source to make more the accurate of music identification and the time indexing, we have not yet reached a 100% recognition ratio and the accuracy of the time indexing. Therefore, we will study this algorithm to reach 100%.

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