Music Identification Using Its Pattern

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Abstract

In this method, we extract peak periods using energy contents of each segment of music. This feature extraction method is equally applied on both the training and query music. Similarity matching algorithm is applied on the extracted feature values for identifying the query music from the database. The retrieval accuracy of 95% of our method is a pretty good result.

I. Introduction

The necessity of multimedia services has lead to the development of processing tools for audiovisual (AV) documents [1]. Audiovisual information that can be handled automatically and precisely [4]. C. M. Kang et. al. extract audio signal from the video segmented by shots and scenes, then they calculate four kinds of audio features like root mean square (RMS), zero-crossing rate (ZCR), fundamental frequency [2][3].

In this paper, we propose a content-based music or song retrieval system. Our objective is to retrieve BGM from a database automatically.

Section II shows the schematic structure of the system. Beat analysis and matching are described in Section III and IV respectively. Experimental results are shown in Section V and conclusion is given in Section VI.

II. Music Retrieval System

Fig. 1 shows the music retrieval system based on beat.

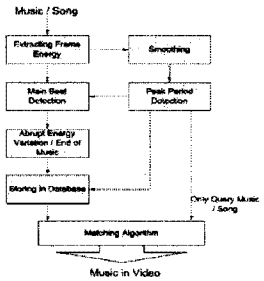


Fig. 1. The Outline of Music Retrieval System.

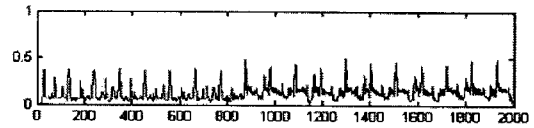
III. Beat analysis

The beats are divided into strong and weak beats. The process is that a strong beat is given more strength than a weak beat and they have regular arrangement. Using this background knowledge, we analyze music wave to determine rising of peak points. If we use only music wave, it is difficult to find beat. So, we divide the total audio sequence into frame units and we measure the energy of each

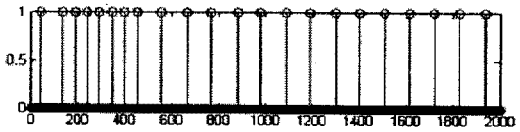
frame and then we propose the analysis and extraction of main beat.

3.1 Main Beat

In Fig. 2, when we plot the energy of frames, we can know that the energies are increased and decreased having constant step and this period τ is main beat.



(a) Energy wave in each frame.



(b) Energy peak points

Fig. **2.** Periodical Frames' Energy

We use the probability of τ in some music to detect the main beat

$$E(m+\tau) = \alpha * E(m) + N(m) \quad (1)$$

Where E(m) is the frame energy in frame m, τ is period, α is constant and N(m) is Gaussian noise. From Eq. (1) we find τ that has probability of energy P(Em|τ). Using Bayesian rule Eq. (1) can be written as Eq. (2)

$$p(\tau \mid E_m) = \frac{1}{z} p(E_m \mid \tau) p(\tau) \quad (2)$$

Eq. (3) can be derived using autocorrelation in Eq. (2)

$$\log p(\tau \mid E_m) = \frac{1}{N^2} \sum_m E_m E_{m-\tau} + cont \quad (3)$$

where N is number of calculations. Finally, we can detect the main beat having high probability of τ using Eq. (3)

$$\hat{\tau} = \arg\max_{\tau} p(\tau \mid E_m) \quad (4)$$

3.2 Peak Period

When the size of database is increased, there is a probability of having similar main beat stream and only using main beat we can not find the exact location of query music. So, we use this peak period as another feature.

Ⅳ. Matching

We compare the database music and query music using Eq. (5)

$$M_{song} = \arg\min_{1 \le i \le N} diff_i$$
$$diff_i = \frac{1}{L^2} \sum^{L} \left| Main_{bp} - Query_{bp} \right| \quad (5)$$

Where, Msong is resulting music, diffi means average of peak periods between query music and detected music in the database i.

Ⅴ. Experimental Results

We use different kinds of music sampled at 22 KHz/16 bits. In query music case, we randomly divide it in the range of 10sec~30sec at various locations. Here we use 22 music file in the database for retrieval. In our experiment correctly identification and location detection rate are of 95% and 91.3% respectively.

Ⅵ. Conclusion

Proposed algorithm in this paper shows very good performance. Although commonly used music analysis methods suffer from computational cost, our approach shows outstanding performance and simple computation based on beat.

Ⅶ. Acknowledgement

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Reference

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