International Journal of Electronics Communication and Computer Engineering
Volume 4, Issue (6) NCRTCST-2013, ISSN 2249–071X

National Conference on Recent Trends in Computer Science and Technology (NCRTCST)-2013

The Theoretical Approach to Music Information System

-A Diasporic Approach

Dattasmita HV MCA, [M.Tech. (IT)]
Assistant System Engineer
Tata Consultancy services, Bangalore, Karnataka
Email: dattasmitahv@gmail.com

Abstract **– Music is one of the major area where the Information retrieval is expected to work smart. The Retrieval of the music based on content was the challenging task but not furthermore. The advances had brought up with many techniques and approaches which indulge the retrieval process to be optimal. The paper unravels the techniques and future challenges in the Music Information retrieval.**

Keywords **– Information Retrieval, Rthydm, Pitch, Metadata, MIR.**

I. INTRODUCTION

Traditional ways of listening to music, and methods for discovering music, such as radio broadcasts and record stores, are being replaced by personalized ways to hear and learn about music.

At present, the most common method of accessing music is through textual metadata. Metadata can be rich and expressive so there are many scenarios where this approach is sufficient. Most music download services currently use metadata-only approaches and have reached a degree of success with them. Content-based music description identifies what the user is seeking even when he does not know specifically what he is looking for. Music is now so readily accessible in digital form that personal collections can easily exceed the practical limits on the time we have to listen to them.

Music researchers who are being challenged by developing content-based music information retrieval (MIR) systems need understanding of the relationships between user dependencies, descriptions of perceived qualities of music and musical content extracted from the audio. One of the weaknesses in music information retrieval research is that their attempts to identify the work are shortage of information on user-dependencies, especially with respect to the importance of high-level features of music. The success of music information technology, however, primarily depends on its users, that is to say on assessing and meeting the variation among user groups. Thus far no research has been investigating who are the potential users of music information retrieval systems, how they would describe music qualities and how we can define the higher-order understanding of music features that the average users share.

II. MIR USERS STUDY

The Global surveys picturizes the fact that internet and the music plays a vital role in a human life. The data for the survey was extracted from a report on the questionnaire. According to the findings in the survey, a global profile of the envisaged users of music information retrieval systems could be outlined. The average music information retrieval system users:

- Are younger than 35 (74%).
- Use the Internet regularly (93%).
- Spent 1/3 of Internet time on music related activities.
- Do not earn their living with music (91%).
- Are actively involved with music.
- Have the broadest musical taste between 12 and 35.
- Have pop, rock and classical as preferred genres.
- Are good at genre description.

III. CONTENT-BASED MUSIC INFORMATION RETRIEVAL

The main concept encovered in this area is about, the overview of traditional music information retrieval techniques, where audio content analysis is used to retrieve or categorize music. Music information retrieval (MIR) is a part of a larger research area— multimedia information retrieval. Researchers working in this area focus on retrieving information from different types of media content: images, video, and sounds. In the following years the field of music information retrieval grew to cover a wide range of techniques for music analysis. For computers (unlike humans), music is nothing else than a form of audio signal. Therefore, MIR uses audio signal analysis to extract meaningful features of music. Nowadays, researchers in the field of multimedia IR (and music IR in particular) focus on methods to bring information retrieval closer to humans by means of human-centric and affective computing . The following section covers the review of the traditional applications of music information retrieval—query by example, query by humming, and genre classification.

3.1. Query by example

Query by example (QBE) was one of the first applications of MIR techniques. Systems implementing this approach are taking audio signal as an input, and return the metadata information of the recording—artist, title, genre, etc. A QBE system can be useful to users who

have access to a recording and want to obtain the metadata information (e.g., finding out which song is playing on the radio, or getting information about an unnamed mp3 file). QBE uses audio fingerprinting technique. It is a technique for representing a specific audio recording in a unique way (similarly to fingerprints representing humans in a unique way) using the low-level audio features.

For instance, a QBE system would recognize an album version of "Let it Be" by The Beatles, but various live performances or cover versions of the same song most likely would not be recognized due to the differences in the audio signal. There are two fundamental parts in audio fingerprinting—fingerprint extraction and matching. Fingerprints of audio tracks must be robust, have discrimination power over huge amounts of other fingerprints, and be resistant to distortions. One of the standard approaches to extract features for audio fingerprinting is calculating the Mel-Frequency Cepstrum Coefficients (MFCCs).The fingerprinting algorithm has to be resistant to noise and distortions, since the users can record audio in a bar or on a street.

3.2. Query by humming

Query by humming (QBH) is an application of MIR techniques that takes an input of a melody sung (or hummed) by the user, and retrieves the matching track and its metadata. QBH systems cannot use the audio fingerprinting techniques of QBE systems since their goal is to recognize altered versions of a song (e.g., a hummed tune or a live performance) that a QBE system would most likely fail to retrieve. As users can only hum melodies that are memorable and recognizable, QBH is only suitable for melodic music, not for rhythmic or timbral compositions (e.g., African folk music). The melody supplied by the user is monophonic. Since most western music is polyphonic, individual melodies must be extracted from the tracks in the database to match them with the query. The standard audio format is not suitable for this task, therefore, MIDI format files are used. Although MIDI files contain separate tracks for each instrument, the perceived melody may be played by multiple instruments, or switch from one instrument to another. A number of approaches to extracting individual melodies from MIDI files have been proposed. The MIDI files are prepared in such a way that they represent not entire pieces, but the main melodic themes (e.g., the first notes of Beethoven's fifth symphony). This helps avoiding accidental matches with unimportant parts of songs, since users tend to supply main melodic themes as queries. To extract such main themes is a challenging task, since they can occur anywhere in a track, and can be performed by any instrument. Since in QBH systems the query supplied by the user is typically distant from the actual recording in terms of low-level audio features like MFCCs, these systems must perform matching at a more abstract level, looking for melodic similarity. Melody is related to pitch distribution in audio segments. In MIDI files, the features describing music content are: pitch, starting time, duration, and relative loudness of every note. For the hummed query, pitch information is extracted by transcribing audio signal into individual notes.

Hidden Markov Models (HMM) are also used in query by humming systems, and allow to model the errors that the users make when humming a query.

In a more recent work, Pardo et al. implemented and compared two approaches to query by humming—the first based on approximate string matching, and the second based on the Hidden Markov Model. The results showed that none of the two approaches is significantly superior to the other. Moreover, neither approach surpassed human performance.

3.3. Genre classification

Unlike the previously described applications of music information retrieval, determining the genre of music is not a search, but a classification problem. Assigning genre labels to music tracks is important for organizing large music collections, helping users to navigate and search for music content, create automatic radio stations, etc. A major challenge for the automatic genre classification task is the fuzziness of the *genre* concept. As of today, there is no defined general taxonomy of music genres. Each of the popular music libraries use their own hierarchy of genres that have little terms in common [22]. Furthermore, music genres are constantly evolving with new genre labels appearing yearly. Since attempts to create a unified all inclusive genre taxonomy have failed, researchers in MIR field tend to use simplified genre taxonomies typically including around 10 music genres. Scaringella et al. [23] presented a survey on genre classification state-of-the-art and challenges. These can be put into three classes that correspond to the main dimensions of music–timbre, melody/harmony, and rhythm.

- *Timbre* is defined as the perceptual feature of a musical note or sound that distinguishes different types of sound production, such as voices or musical instruments. The features related to timbre analyze spectral distribution of the signal.
- *Melody* is defined as the succession of pitched events perceived as single entity, and *harmony* is the use of pitch and chords. The features related to this dimension of music analyze pitch distribution of audio signal segments.
- *Rhythm* does not have a precise definition, and is identified with temporal regularity of a music piece. Rhythm information is extracted by analyzing beat periodicities of the signal.

3.4. Multimodal analysis in music information retrieval

Multimedia data, and music in particular, comprises different types of information. In addition to the audio signal of music tracks, there are also lyrics, reviews, album covers, music videos, text surrounding the link to a music file. This additional information is rarely used in

traditional MIR techniques. However, as MIR tasks are facing new challenges, researchers suggest that additional information can improve the performance of music retrieval or classification techniques. The research concerned with using other media types to retrieve the target media items is called *multimodal analysis*. An extensive overview of multimodal analysis techniques in MIR was given by Neumayer and Rauber [30]. Knopke [31] suggested using information about geographical location of audio resources to gather statistics about audio usage worldwide.

IV. Conclusion and Future Challenges

The paper can be concluded with the thought that the technologies never stop growing nor the research. The MIR is being one of the major developing and Research area, the optimal usage is the main aim. The best effective retrieval of content is expected. The following are the few research areas and the challenges.

1. Scaling Content-Based Search to Millions of Tracks

Pandora is an example of a working MIR system. It is a popular music service that has a large user base. But it does not scale to the size of a million-track database because of the effort required in describing a track and the consistency requirements on track description. This is why we currently do not see, for example, content-based MIR as part of the iTunes interface: the current tools and techniques do not yet scale to millions of tracks. Next generation MIR systems must address this and bring content-based methods to the larger music services and digital libraries.

2. User Focus

As a final observation for MIR, it is interesting to note that most of the activity in the field has been engineeringled. There have been very few user studies that attempt to understand and evaluate the way that MIR tools get used by nonresearch communities. New research is required to better understand: requirements on user control of search; integration of MIR with professional work flows such as music production and engineering, musicology research, and music archiving; and how users navigate million-song music download services

3. Integration of Tools and MIR Frameworks

The music information research community has created a significant number of tools and frameworks, as discussed in Section VII. To create new systems it is beneficial to integrate such existing tools because they have well-known properties and are widely understood by researchers and developers.

Integrating such tools is not easy. This is largely because the input, output, and parameter formats are completely different between frameworks.

References

[1] http://www.allmusic.com
[2] http://www.amazon.com
[3] http://www.mp3.com.
[4] http://www.google.co.in/url?sa=t&rct=j&q=& esrc=s&source=web&cd=15&cad=rja&ved=0CE8QFjAEOAo&url=http%3A%2F%2Fwww.researchgate.net%2Fpublication%2F46676670_Content_Based_Music_Retrieval%2Ffile%2F3deec51df16a37c331.pdf&ei=21hjUsn-A-PmiAf794HwDQ&usg= AFQjCNFjvf8ugcgZ8fnX6Zno3QEPsFtTGQ&bvm=bv.54934254,d.aGc
[5] http://www.doc.gold.ac.uk/~mas01cr/teaching/cc346/chapter.pdf
[6] http://en.wikipedia.org/wiki/Music_information_ retrieval
[7] http://www.pandora.com.
[8] http://www.pandora.com/mgp.shtml.
[9] http://musicovery.com/.