

# EMIR: A Novel Emotion-based Music Retrieval System

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**Abstract.** Music is inherently expressive of emotion meaning and affects the mood of people. In this paper, we present a novel EMIR (Emotional Music Information Retrieval) System that uses latent emotion elements both in music and non-descriptive queries (NDQs) to detect implicit emotional association between users and music to enhance Music Information Retrieval (MIR). We try to understand the latent emotional intent of queries via machine learning for emotion classification and compare the performance of emotion detection approaches on different feature sets. For this purpose, we extract music emotion features from lyrics and social tags crawled from the Internet, label some for training and model them in high-dimensional emotion space and recognize latent emotion of users by query emotion analysis. The similarity between queries and music is computed by verified BM25 model.

**Keywords:** Music Information Retrieval, Emotion Detection, Machine Learning, Human Computer Interaction

## 1 Introduction

Music is an indispensable element in our daily life and inherently expressive of affective meaning. But prevalent music searching and sharing systems (*Google Music*, *Last.fm* and *Xiami Music* etc.) prompt users to input music descriptive keywords (*title*, *album*, *artist* and *singer* etc.) to search for songs. But in many cases, MIR system users may have no specific piece of music in mind but only prefer to tell the system what kind of emotional music that they want to listen to. They may just submit a query like “I fall in love now” or “Feeling Depressed”. We refer to these kind of queries as Non-Descriptive Queries (NDQs), in that they contain no music descriptive information but really shows the implicit emotional need of searchers. Hence there is a new type of semantic gap to be solved; the gap between a user’s emotional feeling (as expressed in the query) and the emotionally expressive content of music. NDQs are more freely input, coherent and inform the system what the user is seeking, though not in a manner that allows easily identifiable content. We try to exploit emotional context to deal with NDQs to develop effective Music IR systems. Text emotion can be categorized into six basic emotion categories (ANGER, DISGUST, FEAR, JOY, SADNESS and SURPRISE) according to WordNet-Affect[5]. Contextual text information such as lyrics has been proved to be effective in music emotion recognition[6]. This work on contextual text information has significant

impact on music emotion recognition, but very few researchers have explored the application of emotion detection in music information retrieval. Likewise, collaborative social tags have become an essential part of solutions to many MIR problems as well as lyrics[3,4]. We propose using emotion detection to enrich MIR. The similarity between music and queries is computed in a higher level of emotion space compared with original key attribute matching method.

## 2 Idea and Implementation

With the consideration of emotion need of MIR system users and inherent emotional expression of songs, we design and implement a demo EMIR System.

### 2.1 Main Idea

The main idea of EMIR system is to recognize the implicit emotional need of music searchers. To design such an Emotional Music Information Retrieval system, we need to tackle following problems:

- 1) Model music representation in an emotion space using the mood definitions from WordNet-Affect.
- 2) Analyze structure of the lyrics of the music to discover potential relationship between emotion and sentence structure.
- 3) Select the best performing feature selection method in emotion detection.
- 4) Design an algorithm to compute emotion similarity and rank retrieval results.

To solve all above significant problems, we consider modeling the process of the retrieval in an emotional space and employ machine learning to assist emotion recognition and presentation. Due to the complicity of emotion based similarity computing method (explicit keyword terms to implicit emotions), we use an increasing saturation to weight the emotions in queries. Finally, we use a revised BM25 to modify the traditional *tf-idf* weighting method, proposed in our previous work[1,2]. The main idea of the demo system can be briefly described in Fig. 1.

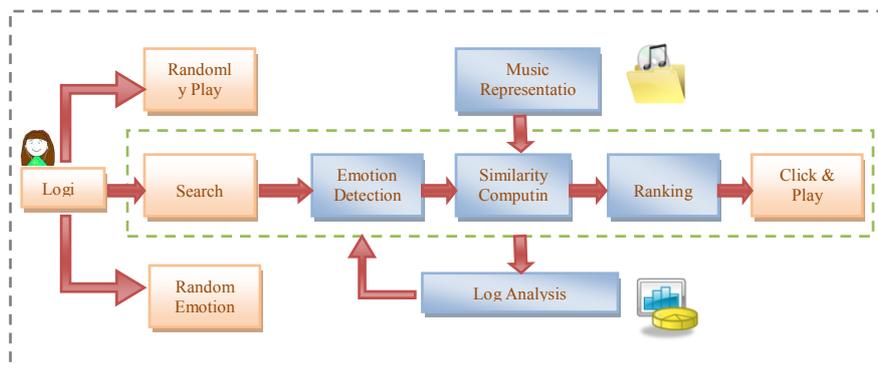


Fig. 1. Flow chart of EMIR system

## 2.2 Prototype MIR System

Our EMIR music retrieval system mainly deals with user music retrieval need by analyzing the emotion of users according to their queries and retrieval logs. Our demo system is implemented to work on Android 2.2 smartphones. As shown in Fig. 2 (l to r), users enter a emotion descriptive textual query through the search interface and our emotion detection algorithm detects the implicit emotion of the query by analyzing the keywords for emotionally meaningful clues, querying the music documents encoded into the emotion space and using our ranking algorithm, we rank the music according to the emotional relevance and present to the user as a ranked list. In the result interface, users can view more detailed information of the song or click the play button to listen as well as add it into personal playlist. The EMIR system also collect user click and input messages to generate the mood curve of users which can be used to show the mood fluctuation of the user over time. In later work, we can analyze this mood fluctuation over time to begin to recommend music to users without requiring an expressive query. Other future work is concerned with increasing the dimensionality of the emotion-space, which is currently six emotions.

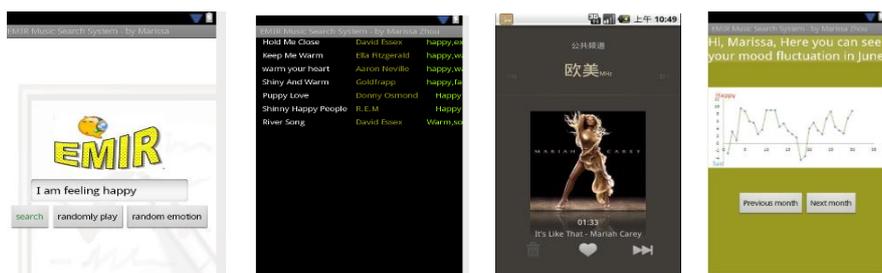


Fig. 2. Screenshots of Search, Result, Playback and Emotion Charting

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