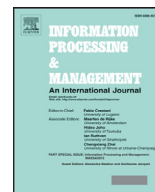




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## Utilizing context-relevant keywords extracted from a large collection of user-generated documents for music discovery

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### ABSTRACT

The contextual background of a user is one of the important criteria when deciding what music to listen to. In this paper, we propose a novel method to embed the user context for music search and retrieval. The proposed system extracts keywords from a large collection of documents written by users. Each of these documents contains a personal story about the writer's situation and/or mood, followed by a song request. We consider that there is a strong correlation between the story and the song. Therefore, by extracting keywords from these documents, it is possible to develop a list of terms that can generally be used to describe the user context when requesting a song, which may then be employed to represent a music item in a richer manner. Once each song is represented using the proposed context-relevant music descriptors, we perform Latent Dirichlet Allocation to retrieve similar music based on context similarity. By conducting a series of experiments, we identified a correlation between the proposed music descriptors and conventional approaches, such as acoustic features or lyrics. The identified correlation can be used to auto-tag songs with no document association. We also qualitatively evaluated our system by comparing the performance of our proposed music descriptors with other conventional features for music retrieval. The results showed that the performance of the proposed music descriptors was competitive with conventional features, thereby suggesting their potential use for describing music in semantic music search/retrieval.

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## 1. Introduction

Proliferation of music data available for users increased the demand of searching and retrieving music that perfectly suits the individual listener's situation and entertainment needs. In order to meet such demands, Schedl and Knees (2013) emphasized the importance of personalized and user context-aware systems. As a consequence, music exploration systems implemented various functionalities in an attempt to provide more satisfying results. Some of the methods to search and retrieve music from such systems are searching music using metadata, retrieving recommended music, and browsing pre-defined playlists (Nanopoulos, Rafailidis, Ruxanda, & Manolopoulos, 2009).

Metadata includes music-related information such as the artist, title, and genre information. Users can query the music exploration system using text to retrieve the exact match. However, metadata lack contextual information, so using a metadata query will not satisfy the user if he or she seeks music in a certain context such as mood or situation. Recently,

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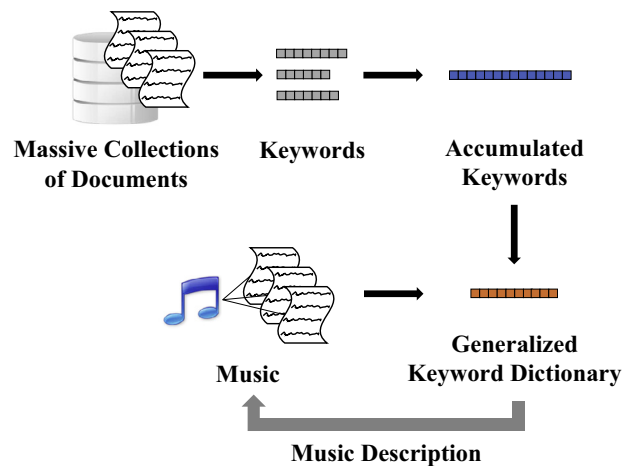


Fig. 1. The concept of the proposed system.

the utilization of social tags to enhance music description has been attempted in the research field of Music Information Retrieval. Symeonidis, Ruxanda, Nanopoulos, and Manolopoulos (2008) gathered social tags obtained from Last.fm to recommend music. However, as Lamere (2008) pointed out, most social tags are related to the artist, title, genre, and instrument, whereas only a small proportion is related to the user context. These social tags enhance text-based music search to some extent but they have difficulties with context-related terms.

Music exploration systems also provide music recommendations to users using various similarity measures. Collaborative filtering algorithms retrieve similar music by discovering similar user preference (Xing, Wang, & Wang, 2014). User preference is inferred by analyzing user ratings and/or user playlist. On the other hand, content-based algorithms utilize music-centric features such as timbre, pitch, and lyrics to discover similar music (Bogdanov et al., 2013; Li, Myaeng, & Kim, 2007; Mayer, Neumayer, & Rauber, 2008). These music-centric features include information obtained from the audio signal itself, but they lack information about the listener. Therefore, these music-centric features have a limited capacity to reflect the needs of the user.

Additionally, playlists tagged with predefined terms are also available in most of the music exploration systems. For instance, Allmusic<sup>1</sup> provides playlists that are tagged with predefined moods and themes. However, the recommendations provided are unbalanced in terms of the song distribution per mood/theme. For instance, the system suggests various songs for the *in love* theme but it only provides one song under the theme of *work*. Another problem is that it is difficult to build a consensus among the users because there is no specific standard for selecting moods and themes.

In this paper, we extract context-relevant keywords from a large collection of user-generated documents to capture the user contextual background when searching for music. Each document comes from a radio program's Internet bulletin board, where it comprises a personal story and a song request. Fig. 1 illustrates the concept of the proposed system. Hyung, Lee, and Lee (2014) showed that there is a strong correlation between personal stories and song requests. There are large number of such documents, so we consider that some general terms will be used to describe the user contextual background when requesting songs. Therefore, by performing keyword extraction based on these documents, it will be possible to create generalized context-relevant music descriptors, which can be applied to music search and retrieval. We collected 186,656 documents sent from the listeners of a radio program aired between 6:00 p.m. and 8:00 p.m.. We chose this program as they only air Western pop songs.

### 1.1. Contribution

In this paper, we introduce a novel approach that utilizes user-generated documents to extract user context for music search and retrieval. We described music using context-relevant keywords extracted from a large collection of user-generated documents. By utilizing context-relevant music descriptors, our system facilitates natural language text querying when searching for music and thus, it can retrieve music that satisfies the entertainment needs of users. Additionally, the keywords describing the user context are extracted from a large collection of documents, so the coverage of the explainable contextual background when listening to music will be broad. Therefore, users will be able to discover music in various contexts. Finally, we determined a correlation between our proposed context-relevant music descriptors and conventional features, such as acoustic features or lyrics, which could provide some insights into how to overcome the cold start problem where pieces of music with no document associations are never discovered.

<sup>1</sup> [www.allmusic.com](http://www.allmusic.com).

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