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Music result ranking by humming with hybrid recommendation

#1Pranjali Nikam, #2Saurabh Khamkar, #3Sankalp Kanchan, #4Sachin Pharate

1pranjali.amore@gmail.com
2saurabh007007@hotmail.com
3sank739peace@gmail.com
4sachinpharate1@gmail.com

#1Teacher, Department of Information Technology,
#234Student, Department of Information Technology,

G.H.R.I.E.T, Pune.

ABSTRACT

Some people like to hear a specific kind of song. Sometimes they might come across a song via radio or in a musical atmosphere where they listen to the song of their favorite genre. They tend to like the song but don't recall/know the name of it. They constantly hum or sing the song and get curious to know its name. For this there is a promising solution is called "QUERY BY SINGING/HUMMING" (QBSH). Query by Singing/Humming is a promising way to retrieve music recording based on main melody's similarity. For example, If a driver listens to a song on radio and is not able to get that song out of his mind then he can simply hum/sing that section of it to get desired song and other songs related to its rhythm. Proposed system will use the user's search history, as well as analyze user's favorite genre. Proposed system can be divided into two phases. In the first phase, we find the possible search results. This is similar to the conventional singing or humming query process. During the second phase the musical preference of the users is utilized to rank the possible search results again. Songs that queried are positioned at the top of the list in the search results.

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I. INTRODUCTION

"Query by humming: Automatically building the database from music recordings"

The aim of this paper is to overcome the main shortcoming of the existing query-by-humming (QBH) systems i.e. Their lack of scalability in terms of the difficulty of automatically extending the database of melodies from audio recordings. A method is proposed to extract the singing voice melody from polyphonic music providing the necessary information to index it as an element in the database.

Advantage

Their experiment conducted showed the matching performance achieved is 85% which is considerably very high.

Disadvantage

Their automatic singing melody extraction from audio recordings is not as accurate as the manual transcription and which decreases the performance of the QBH system

"A repeating pattern based Query-by-Humming fuzzy system for polyphonic melody retrieval".

Here Query-by-Humming involves retrieving music with a melody that matches the hummed query. An improved Query-by-Humming system for extracting pitch contour information based on a fuzzy inference model is introduced in proposed system. In addition, an improved content-based music repeating pattern extraction model is also introduced.

Advantage

Their method can be applied to complete as well as effective music which is useful for the automatic establishment of music databases.

Disadvantage

In this experiment the size of the database is needed including other types of music to test system scalability and robustness of the method to other genres of music.

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"An FFT-based fast melody comparison method for query-by-singing/humming systems"
This paper presents an efficient QBSH method that enables fast melody comparison. The proposed method performs distance computation in the frequency domain. This is done with the fast transform, which converts different-length note sequences into equal dimension vectors via zero padding. The equal dimensionality allows us to compare the vectors using Euclidean distance directly, which avoids performing time-consuming alignment between sequences. The proposed fast melody comparison method is combined with the dynamic time warping technique into a two-stage sequence matching system.

Advantage

Their shows that they have developed an efficient QBSH system which enables fast melody matching of note sequence.

Disadvantage

Their experiment shows that the computational complexity of the baseline DTW-based system is so high that it is not acceptable in practical QBSH applications.

"Effective Results Ranking for Mobile Query by Singing/ Humming Using a Hybrid Recommendation Mechanism"
It includes, signal processing of sung/ hummed melody and Ranking technology and the experimental results are based on the user's profile and it was also observed that, system can improve the accuracy if the user has a sufficient level of query history. (e.g. more than 40 previous queries). Based on the experimental data, under a specific value, RBP, PHR, and HR all achieve superior performance to PQBH.
2.1.3.2"A Query-by-Singing System based on Dynamic Programming"
It includes Comparison engine implementation based on Dynamic Programming In this system, a hierarchical approach for combining DTW-based comparison engines is proposed and used in a CBMR system. The performance and response time of the simulation demonstrate the feasibility of the system in operation.

II. PROPOSED SYSTEM

In proposed system, we use the information from a user's search history, as well as the properties of genres common to users with similar backgrounds, to estimate the genre or style, the current user may be interested in, based on a probability calculation. The accuracy from querying by singing/humming system is improved. Proposed system is focused on research on filtering unnecessary query results to reduce the operating procedures required by the user. This is achieved by use of probability calculations regarding various similarity factors of users‟ likings.

III. TECHNOLOGY USED

There are total three Techniques'

1. Contour string generation methodology
2. Match Processing (Using Edit Distance Method.)
3. Hybrid recommendation method
4 Ranking by user's Preference Method

Contour String generation methodology:

Here, the MIDI files analyzes the rhythm and generates rhythmic contour string.

We have considered 'rhythm' as sequence of note durations and 'beats' as length of time from one note to another and stored them in MIDI.

Each beat in the MIDI form is represented as a triplet (v, u, d), where v is the pitch scale, u is onset time and d is offset time. Then „v‟ is represented in the form of pitch scale (v1, v2,…,vn) based on which contour string is generated.

Contour string will be as shown in table: For song "Twinkle, Twinkle, Little Star" Following contour string is generated:

Formula to Calculate Contour String

$$C_i = V_{i+1} - V_i$$

Where C is the contour string
V is the pitch string
i= 1, 2, 3…….n

Match Processing (Using Edit Distance Method):

Once we get both user query and song in database in the contour string form, we can readily compare user query with each song stored in database. For query matching dynamic programming is the best way.

For comparison purpose, user query contour string is denoted as p(p1, p2,.., pm) and database song contour string is represented as q(q1, q2,… , qm).

Edit distance is Calculated using these two strings. Edit distance (ED) is a common distance metric to measure the similarity between two contour strings.

On one hand our QBSH system employs melody strings to represent the input query and entries in database, on the other hand in order to balance user singing or errors in humming, the relative pitch can be better to represent the coarse melody contour.

Therefore the ED method is suitable to calculate similarity between transcribed query and indexed melodies with relative pitch. The edit distance between two compared sequences can be defined as the minimal transitional number of note inclusion, deletion and replacement which are necessary operations to transform source sequence into target sequence.

The selection of appropriate cost function, make the ED to take user errors into consideration. Inclusion cost covers extra notes hummed by user, while the deletion cost accounts for notes skipped by user.

To avoid a song with two or more segments matching a query, and all of these segments becoming the search results, for every song, we only consider the segment with the smallest edit distance to be the determining factor used to decide if this segment can be a search result or not.

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For the search process, songs with small edit distances are considered to be the potential results. They are called „k" candidates. These k candidates are used for re-ranking purpose, so that optimized results are generated by QBSH system. This re-ranking makes our QBSH different from other QBSH systems which do not consider user history for result generation.

Hybrid recommendation method:

It is used to provide optimal search quality.

This method helps the desired target to be ranked at higher position in the list.

This method is an outcome of content-based and collaborative based filtering.

If content based filtering is to popularity then collaborative based is to history of related searches.

Ranking by User's Preference Method:

In this ranking process we consider users preferences.

A user often searches for a song that is related to their interest.

Example for a user who likes Rock music, their probability of searching for a Rock song is higher than that of classical song.

In the second searching stage, in addition to comparing query with previous history, we also consider the genre of music files that were searched by the user previously

IV. CONCLUSION AND FUTURE WORK

Searching of songs made possible by singing or humming. User will also be able to download or stream the songs online on YouTube via hyperlink. No need to know the title of the song or name of the artist to perform a search. The development of a more accurate pitch extraction and a faster filtering process, more precise recommendation system will be topics of concern for future study.

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