Exercise 3 - Multimedia Data Mining

Group09

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# Introduction

In this assignment, we performed a task in the Music Information Retrieval field, the audio music similarity and retrieval.

# Dataset Preparation

For the dataset, we have downloaded and used the following collection:

<http://kronos.ifs.tuwien.ac.at/ISMIRgenre_mp3_44khz_64kbit_mono_30sec.zip>

This collection consists of 6 classes (genres):

* Classical
* Electronic
* Jazz\_blues
* Metal\_punk
* Rock\_pop
* world

We used the Collection provided in the slide seeking for diversity in the collection, we used five very different genres:

Classical, Electronic, Jazz Blues, Metal-Punk and Rock-Pop.

Predominant characteristics of classical group is wide use of string instruments like violin, viola and cello and also Harpsichord and Piano as well as female voices, normally in highest pitch and men voices in low pitch.

In Jazz & Blues the use of woodwind/wind instruments such as saxophone and trumpet, and other instruments like drums, piano and guitar is predominant.

Electronic Music makes use of different electronic music instruments such as sound synthesizer and vocals (sometimes digitalized).

Metal & punk makes use of electric guitar, bass and drums as well as vocals (low in pitch and very loud).

Rock & Pop the prominent use of acoustic guitar, electric guitar, drums, synthesizer, keyboards and vocals is perceivable.

In World group many different traditional instruments which are associated to specific nations/countries (e.g. Indian, Persian instruments) are used.

There are some similarities between Metal and Rock groups, since the instruments used in both groups, such as electric guitar, are similar. But there are some differences which help to discriminate these two groups. One is the loudness; Metal songs are normally louder than Rock songs. Also the tempo of Metal song is more than Rock songs.

TODO: anything more?

# Evaluation Preparation

# Feature Extraction

For feature extraction, we use AudioFeatureExtraction software.

There were three features sets available: the Rhythm Histogram (RH), Rhythm Pattern (RP) and Statistical Spectrum Descriptor (SSD), which we focused on RH and SSD.

The collection that we use for our experiment consists of 30 second segments of songs in mono channel. Therefore no preprocessing was needed. These unified 30-sec segments will help find matches more precisely.

# Perform similarity retrieval

We performed the similarity retrieval using SOMToolbox software

# Evaluate and Summarize Results

The result is made by comparing two different feature sets (SSD and RH) and two different metrics. In summery we performed:

10 query songs with feature set RH, L2Metric;

10 query songs feature set SSD, L2Metric;

10 query songs feature set SSD, L1Metric

We evaluate the top 1-5th,10th, 20th, 40th, 50th and 100th songs retrieved for the two first songs of each genre, as shown in Table 1. For each query song, two graders attributed a categorical broad score**2**:

• 0 - Not similar

• 1 - Similar

• 2 - Very Similar

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| query | 1 | 2 | 3 | 4 | 5 | 10 | 20 | 40 | 50 | 100 | TotalRate |
| Classical 1  RH-L2Metric  SSD-L2Metric  SSD-L1Metric | 2  1  2 | 2  2  2 | 2  2  2 | 2  1  2 | 1  1  2 | 1  2  1 | 0  0  0 | 0  2  0 | 0  0  0 | 1  0  0 | 11  11  11 |
| Classical 2  RH-L2Metric  SSD-L2Metric  SSD-L1Metric | 1  2  2 | 2  2  2 | 1  2  2 | 2  2  2 | 2  1  1 | 0  1  2 | 2  0  0 | 0  0  1 | 0  1  1 | 1  0  1 | 11  11  14 |
| Electronic 1  RH-L2Metric  SSD-L2Metric  SSD-L1Metric | 2  0  0 | 1  1  1 | 1  0  0 | 0.5  0  0 | 0  0  0 | 0  1  0 | 1  0  1 | 0  2  1 | 0  0  1 | 0  0  0 | 5.5  4  4 |
| Electronic 2  RH-L2Metric  SSD-L2Metric  SSD-L1Metric | 1  2  2 | 1  1  1 | 0  0  0 | 0  0  0 | 0  1  1 | 1  2  0 | 0  0  0 | 0  0  0 | 0  0  0 | 0  1  1 | 3  7  5 |
| Jazz Blues 1 RH-L2Metric  SSD-L2Metric  SSD-L1Metric | 0  2  2 | 0  0  0 | 1  2  0 | 0  2  2 | 0  2  1 | 0  2  2 | 0  1  1 | 0  0  0 | 2  2  2 | 0  1  1 | 3  14  11 |
| Jazz Blues 2  RH-L2Metric  SSD-L2Metric  SSD-L1Metric |  |  |  |  |  |  |  |  |  |  |  |
| Metal Punk 1  RH-L2Metric  SSD-L2Metric  SSD-L1Metric | 2  2  2 | 2  2  2 | 2  2  2 | 1  1  2 | 1  1  2 | 1  1  1 | 1  1  0.5 | 1  0.5  0.2 | 1  1  1 | 0 (classical!)  0 (elec)  0.5 (rock) | 12  11.5  13.2 |
| Metal Punk 2  RH-L2Metric  SSD-L2Metric  SSD-L1Metric | 0 (classic violin)  2  2 | 2  2  1 | 0  1  1 | 2  2  2 | 2  1  2 | 1  1  1 | 1  1  0 | 0  1.5  1.5 | 0  0.7  1 | 0  0  1 | 8  10.2  12.5 |
| Rock Pop 1  RH-L2Metric  SSD-L2Metric  SSD-L1Metric | 2  0.4  0.4 | 2  0.4  0.4 | 2  0.4  0.4 | 1  0.4  0.4 | 1  0.4  0.4 | 0.4  0.4  0.4 | 1  0.4  0.4 | 1  0.4  0.4 | 0.4  0.4  0.4 | 0.2  0.4  0.4 | 11  4  4 |
| Rock Pop 2  RH-L2Metric  SSD-L2Metric  SSD-L1Metric |  |  |  |  |  |  |  |  |  |  |  |

Table 1: Results.

Table 2 shows the location, at which the second song of the similar/dissimilar pairs is.

|  |  |  |
| --- | --- | --- |
| query | Similar Song Location in Result List | Dissimilar Song Location in Result List |
| Classical 1  RH-L2Metric  SSD-L2Metric  SSD-L1Metric | 83  29  12 |  |
| Classical 2  RH-L2Metric  SSD-L2Metric  SSD-L1Metric |  | Not in first 100 result (>100)  Not in first 100 result (>100)  Not in first 100 result (>100) |
| Electronic 1  RH-L2Metric  SSD-L2Metric  SSD-L1Metric | Not in first 100 result (>100)  28  40 |  |
| Electronic 2  RH-L2Metric  SSD-L2Metric  SSD-L1Metric |  | Not in first 100 result (>100)  Not in first 100 result (>100)  Not in first 100 result (>100) |
| Jazz Blues 1  RH-L2Metric  SSD-L2Metric  SSD-L1Metric | Not in first 100 result (>100)  1  1 |  |
| Jazz Blues 2  RH-L2Metric  SSD-L2Metric  SSD-L1Metric |  | Not in first 100 result (>100)  Not in first 100 result (>100)  Not in first 100 result (>100) |
| Metal Punk 1  RH-L2Metric  SSD-L2Metric  SSD-L1Metric | 9  3  3 |  |
| Metal Punk 2  RH-L2Metric  SSD-L2Metric  SSD-L1Metric |  | Not in first 100 result (>100)  Not in first 100 result (>100)  Not in first 100 result (>100) |
| Rock Pop 1  RH-L2Metric  SSD-L2Metric  SSD-L1Metric | 21  Not in first 100 result (>100)  39 |  |
| Rock Pop 2  RH-L2Metric  SSD-L2Metric  SSD-L1Metric |  | Not in first 100 result (>100)  Not in first 100 result (>100)  Not in first 100 result (>100) |

Table 2: Location of similar/dissimilar songs in Result List.

From Table 2 it is perceivable that:

* Since none of dissimilar songs are within top 100 results returned by the software, we as humans are in strong agreements with the machine perception about dissimilarity of songs.
* In general (except one case) the Location of similar song using SSD feature set is more close to top of ranking list than the RH.

|  |  |
| --- | --- |
| Query Name | Song |
| Classical 1 (1=taken from similar set) | classical\_artist\_15\_album\_2\_track\_4 |
| Classical 2 (2= taken from dissimilar set) | classical\_artist\_10\_album\_1\_track\_2 |
| Electronic 1 | electronic\_1-dezert |
| Electronic 2 | electronic\_8-ehaw |
| Jazz Blues 1 | jazz\_blues\_18-slide\_boogie |
| Jazz Blues 2 | jazz\_blues\_3-my\_momma\_told\_me |
| Metal Punk 1 | metal\_punk\_6-in\_my\_livid\_eyes |
| Metal Punk 2 | metal\_punk\_7-heavenly\_rain |
| Rock Pop 1 | rock\_pop\_3-air\_chair |
| Rock Pop 2 | rock\_pop\_12-sympathetic\_stranger |

Table 3: Mapping between Query names used in this report and the song titles.