Shades of Music

Projektarbeit

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Goal

≡ Recommendation of relevant objects (based on their similarity to a user's choice [Query-by-Example])

≡ Measure musical similarity for song segments instead of whole songs to consider the inner diversity of a song

≡ Visualize the emerging links between songs

Von Last.fm empfohlene Musik

DANGERDOOM
Ähnlich wie: Deltron 3030, Del tha Funkee... , Jaylib

Hieroglyphics
Ähnlich wie: Deltron 3030, Del tha Funkee... , Souls of Mischief

Handsome Boy Modeling School
Ähnlich wie: Deltron 3030, Del tha Funkee...

Dr. Octagon
Ähnlich wie: Deltron 3030, Del tha Funkee...

Music recommendation by last.fm [1]

Overview

≡ Related Work

≡ Similarity Measuring

≡ Segmentation

≡ Shades of Music

≡ General Concept

≡ Backend Calculations

≡ Graphical User Interface

≡ Conclusion & Outline

Symbolic Similarity Measuring

≡ Use existent data such as

≡ Lyrics

≡ Scores

≡ Midis

≡ Rhythmic patterns

≡ Tags (e.g. ID3-Tags)

≡ Intuitive

≡ Easy to use and understand

German national anthem [2]

Acoustic Similarity Measuring

≡ Measure data derived from the audio file, such as

  ≡ Loudness

  ≡ Pitch

  ≡ Timbre

  ≡ Bar & Beat (~ Rhythm)

  ≡ Tempo

≡ Raw input → no faults

≡ But: limited technique, no subjectivity

Subjective Similarity Measuring

≡ Likeness is subjective and music is emotional

≡ Music classification should include listener's subjectivity
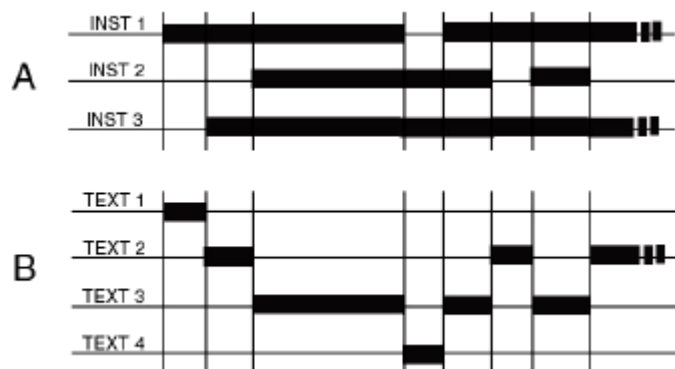
≡ Collaborative Filtering

Segmentation

≡ General idea: repetition

  ≡ Self-Similarity

  ≡ Verse & Chorus scheme

≡ Audio thumbnails

A: Midi representation

B: Texture representation

Segmentation by [4]
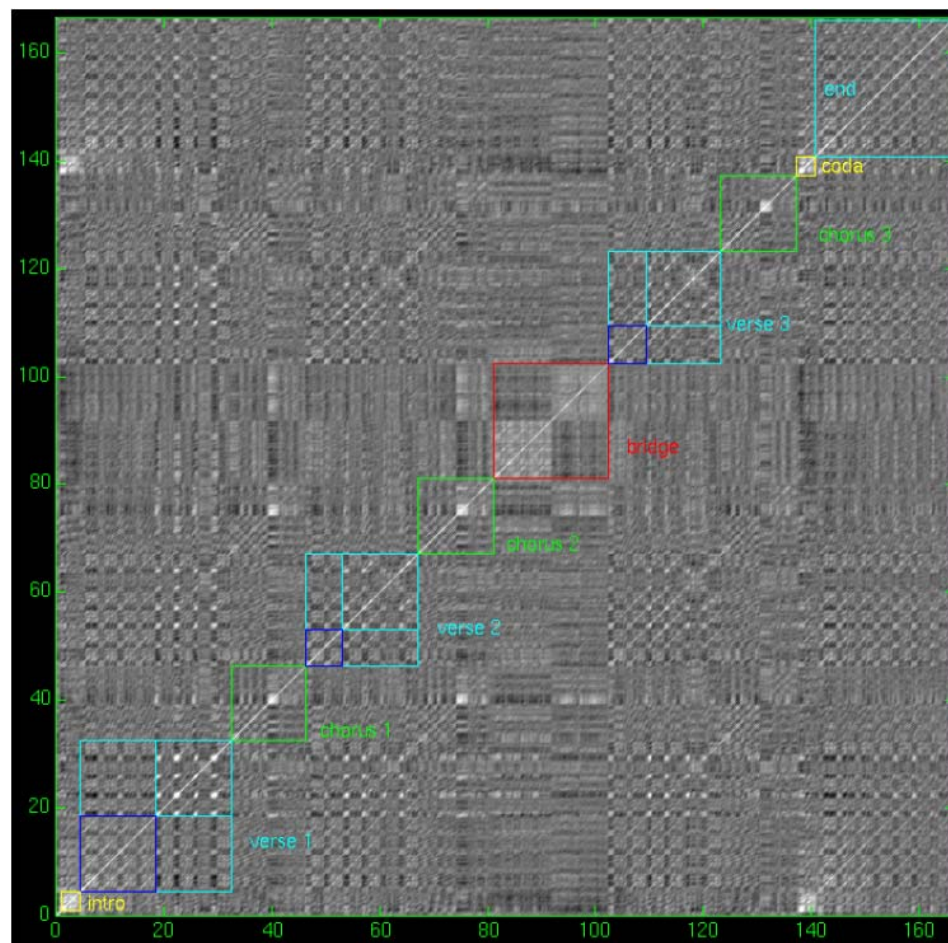
Day Tripper by Lennon/McCartney, performed by the Beatles

Self-Similarity [3]

Shades of Music

≡ Query-by-Example paradigm

   ≡ Faithless – God Is a DJ used for this presentation

≡ Recommend music

≡ Discover unknown links

≡ Web-based multi-user system

   ≡ Subjective Similarity through Feedback process

   ≡ Collaborative Filtering possible

   ≡ User-Clustering possible (not used)

Shades of Music

≡ Use Case

≡ Users upload their songs

≡ Analyze songs & calculate similarities (own collection only)

≡ Listen to songs and find sections from other song similar to the one currently playing

Shades of Music - Backend

≡ Calculation using "The Echonest.com" framework

   ≡ Segmentation of a song into song sections

   ≡ Acoustic attributes

≡ Aggregate Segments (milliseconds) and their measured attributes with the sections (seconds)

≡ Similarity indicated by the absolute difference between the attribute's values, of two sections, proportional to the maximum
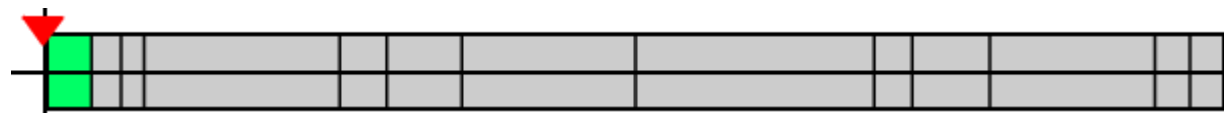
Sections of "Faithless – God is a DJ"

Shades of Music - Backend

≡ Calculation example

Halbton	Wert Vektor 1	Wert Vektor 2	Wert Vektor 3	Wert Vektor 4	Wert Vektor 5	Durchschnitt
0	0.368	0.442	0.584	0.394	0.306	0.419
1	0.971	0.78	0.73	0.496	0.643	0.724
2	0.13	0.228	0.144	0.148	0.327	0.195
3	0.22	0.181	0.152	0.147	0.466	0.238
4	0.165	0.237	0.141	0.16	0.512	0.243
5	0.614	0.505	0.448	0.754	0.684	0.601
6	0.212	0.274	0.256	0.238	0.354	0.267
7	0.103	0.257	0.125	0.212	0.388	0.217
8	0.152	0.204	0.397	0.694	1	0.489
9	0.15	0.249	0.227	0.428	0.407	0.292
10	1	1	1	1	0.72	0.944
11	0.237	0.228	0.174	0.247	0.213	0.22

Halbton	Wert 1	Wert 2	abs. Differenz
0	0.419	0.681	0.262
1	0.724	0.754	0.03
2	0.195	0.615	0.420
3	0.238	0.39	0.152
4	0.243	0.442	0.199
5	0.601	0.499	0.102
6	0.267	0.385	0.118
7	0.217	0.365	0.148
8	0.489	0.453	0.036
9	0.292	0.426	0.134
10	0.944	0.308	0.636
11	0.22	0.422	0.202

Calculation of the average pitch chroma-vector for the last section of "Faithless – God is a DJ"

Absolute pitch difference between the last section from "God is a DJ" and a 80 second long section from "Thriller"

Shades of Music - Backend

- ≡ Feedback integration

  - ≡ Feedback overrides acoustic measurement

  - ≡ Stored value = (feedback scale value – 1) * 0.25 → range from 0.0 to 1.0 just like the calculations

  - ≡ Use the accumulated average value from all known votes for an entry belonging to section A and section B

  - ≡ Vote on total → adjust all other attributes

- ≡ User links via duplicated songs

  - ≡ Detection through Levenshtein distance

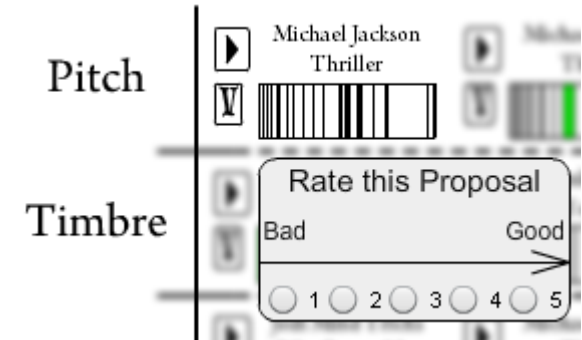 - ≡ Use existing entry that is already linked to other users

Shades of Music - Interface
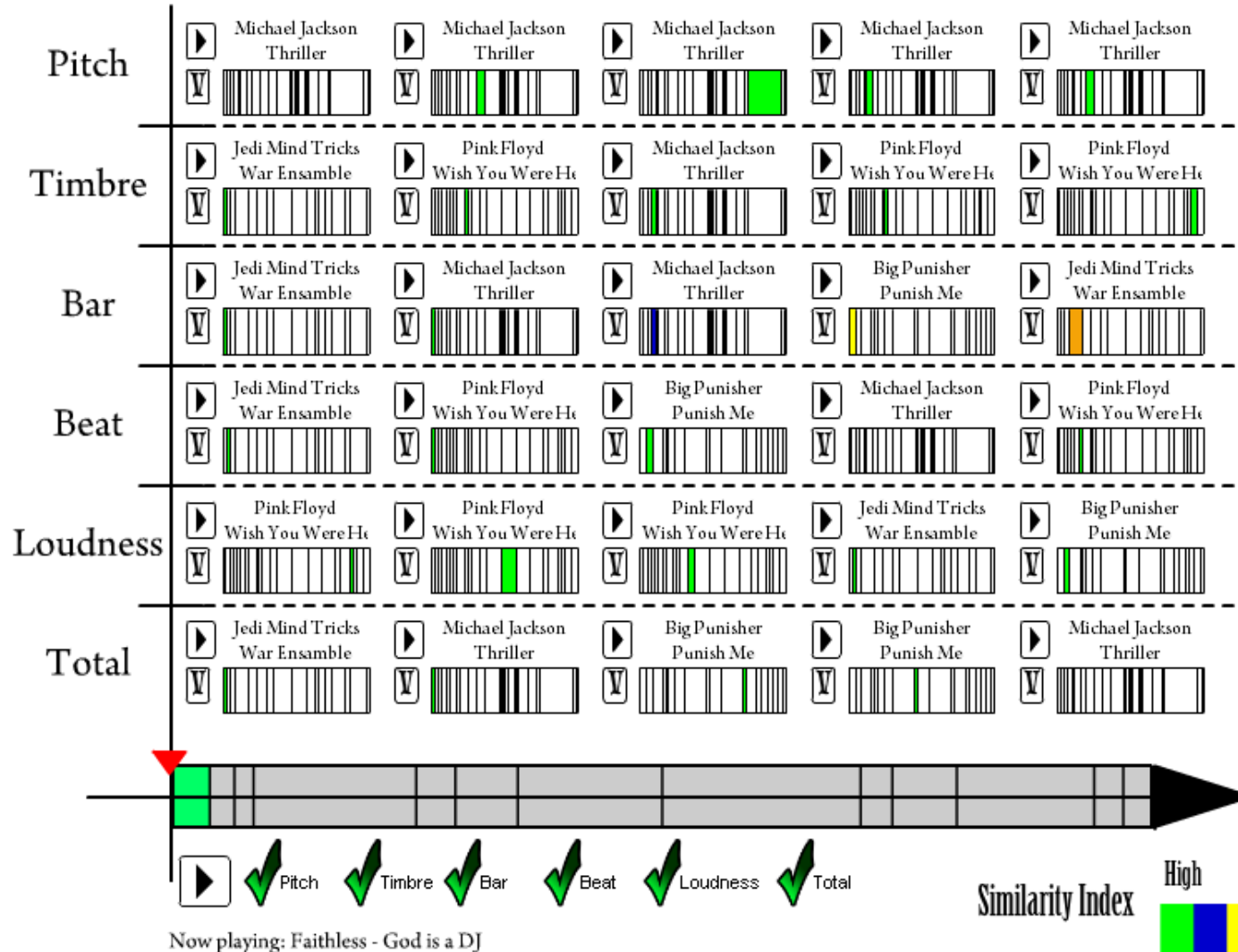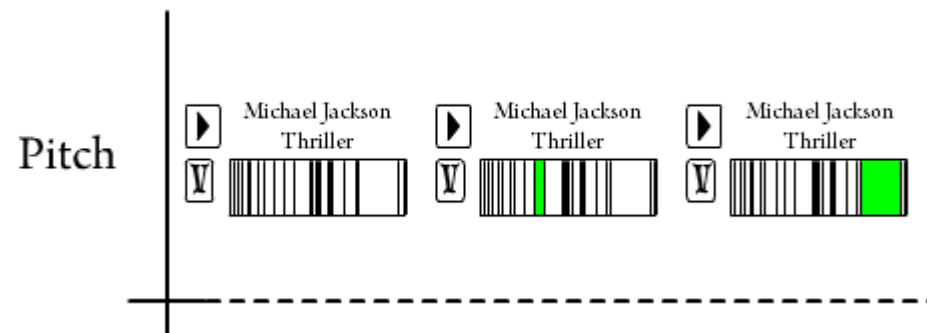
Shades of Music - Interface

≡ Interaction possibilities

   ≡ Play a song (of course!)

   ≡ Select similarity attributes to display

   ≡ Rate a recommendation (scale 1 to 5)

   ≡ Play a recommended song

Voting option

Detail view of the pitch-wise recommendations for

"Faithless – God is a DJ"

Conclusion

Problems

- Scalability: (n*(n-1))/2 comparisons for each attribute

- Echonest segmentation unsatisfactory

- Acoustic measuring can only be a first step (feedback included but requires a lot of work to improve the system)

- Varying section length (e.g. compare a 2s section with a 20s section) leads to low meaningful results

- No local file upload

- No section labeling (e.g. Verse & Refrain) – would be helpful

Possible Extensions & Outlook

≡ Extensions

   ≡ Allow to create, delete and edit section borders

   ≡ Integrate user spanning song similarities (currently excluded)

≡ Alternative use cases

   ≡ Compare a calculation-only system with a user-only system

   ≡ Visualize larger collections with song-section links (no Query-By-Example)

   ≡ Find music samples (similar to Whosampled.com) and/or split remixes or mixed songs (e.g. DJ Sets)

Quellen

(1) www.last.fm

(2) www.hkbu.edu.hk

(3) J. Foote. Visualizing music using self-similarity. In *Proceedings of the seventh ACM international conference on Multimedia (Part 1)*, pages 77-80. ACM New York, NY, USA, 1999

(4) J. Aucouturier and M. Sandler. Segmentation of musical segments using hidden Markov models. *Preprints-Audio Engineering Society*, 2001