harmony-analyser.org
Java Library and Tools for Chordal Analysis

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What is this library about?

- Music Analysis
- Tonal Harmony / Western music – but likely to extend
- Chord Distances (Musicology, music cognition)
Motivation (why to research chord distances?)

- New descriptors for MIR (e.g. cover song identification)
- New visualizations for music
- Gap between Musicology and MIR
harmony-analyser is a set of visual tools for music harmony analysis of WAV/MIDI input, powered by JHarmonyAnalyser library.

The difference we bring is the approach based on music theory, chord and chroma distances. JHarmonyAnalyser uses recent music theory models to extract musical meaning and distances between chords and chroma vectors. We aim to develop open-source music player, which is musician / musicologist-friendly and aid recent music information retrieval tasks.

harmony-analyser tools and JHarmonyAnalyser library are licenced under the GNU GPL License.

Tools are compatible with GPL Licensed Vamp plugins which can be used for additional analysis.

To contribute, please follow our guideline in GitHub repository.

Releases

Please choose from the releases below:
Tools: Chord Transition Tool

Chord Transition Tool

MIDI Input Devices
No MIDI devices found

Chord Mode

Name: Cmaj5

Pitches: C E G

Structure: major triad

Chord Complexity Distance

Chord: C major (Tonic)
Steps: 0

Chroma Mode

Name: Cmaj5

Pitches: C E G

Structure: major triad

List of Functions / Chord Complexity

C major (Tonic)
root: C E G steps: 0

F major (Dominant)
root: C E G steps: 0

List of Functions / Chord Complexity

C major (Tonic)
root: C E G steps: 0

TPS Distance

Distance: 5.5
Tools: Chord Transition Tool

Chord Mode

Name: Cmaj5
Pitches: C E G
Structure: major triad, perfect fifth

List of Functions / Chord Complexity
C major (Tonic) root: C E G steps: 0
F major (Dominant) root: C E G steps: 0

Chord Complexity Distance
C maj: Tonic->Dominant steps: 1
G maj: Subdominant->Tonic steps: 2
A min: Dominant->Subdominant steps: 3
E min: Tonic->Dominant steps: 4

Chroma Mode

Name: Gdom4-3
Pitches: D F G B
Structure: dominant four-three chord, perfect fourth, major sixth

List of Functions / Chord Complexity
C major (Dominant) root: D G B steps: 1
D major (Subdominant) root: D G B steps: 2

TPS Distance
1
5.5
Tools: Audio Analysis Tool

Audio Analysis Tool

Folder name: /mnt/work/school/mfl/Articles/WOCMAT2016/Demo/Analysis

Available Plugins
0: nnls-chroma-chordino
1: nnls-chroma:nnls-chroma
2: nnls-chroma:tuning
3: qm-vamp-plugins:qm-adaptivespectrogram
4: qm-vamp-plugins:qm-barbeattracker
5: qm-vamp-plugins:qm-chromagram
6: qm-vamp-plugins:qm-constantq
7: qm-vamp-plugins:qm-dwt
8: qm-vamp-plugins:qm-keydetector
9: qm-vamp-plugins:qm-mfcc
10: qm-vamp-plugins:qm-onsetdetector
11: qm-vamp-plugins:qm-segmenter
12: qm-vamp-plugins:qm-similarity
13: qm-vamp-plugins:qm-tempotracker
14: qm-vamp-plugins:qm-tonalchange
15: qm-vamp-plugins:qm-transcription

Chordino
Chordino VAMP Plugin

Settings  Analyse

Beginning analysis: nnls-chroma:nnls-chroma
Input file(s):
 Output file:
 Wav file: Hallelujah_Alexandra_Burke-652946.wav
Sample rate: 44100.0
Channels: 2
Bytes per frame: 4
Output: Chromagram
Tools: Visualization Tool

Visualization Tool

Chord Complexity Distance

TPS Distance

- Tonal Pitch Space (Fred Lerdahl)

TPS of C major chord in a C major key

\[
\begin{array}{cccccc}
(a) & 0 & & & & (0) \\
(b) & 0 & 7 & & & (0) \\
(c) & 0 & 4 & 7 & & (0) \\
(d) & 0 & 2 & 4 & 5 & 7 & 9 & 11 & (0) \\
(e) & 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 & 11 & (0)
\end{array}
\]
Our novel concept: Chord Complexity Distance

(a variation of Edit Distance)
Experimental: Chroma Distances

- Idea: If chord distances work, why chroma distances shouldn't
SimpleDifference $sd(x,y)$ for chroma vectors $x$ and $y$:

$$sd(x,y) = \sum_{i=1}^{12} |x_i - y_i|$$

ComplexityDifference $cd(x,y)$ for chroma vectors $x$ and $y$:

$$cd(x,y) = \sum_{i=1}^{12} |w(x)_i x_i - w(y)_i y_i|$$
JHarmonyAnalyser

- Basic model of tones, chords, keys, …
- Implementation of chord distance models (Tonal Pitch Space, Chord Complexity, …)
- Experimental chroma distances
- Extensible plugins
Conclusion and Future work

- harmony-analyser.org = Java library and ready-made tools
- New Chord Complexity distance concept
- Chroma distances
- Future work: Chew model, Maven repository
Thank you for your attention
- Similar to formal grammars
- Basic harmonic function = start sentential form
- 2 rules applicable on sentential form:
  - ADD – adds a new tone
  - ALTER – alters the tone
- Example:

```
CEG  ADD  CEFG  ALTER  CEF#G  ALTER  CEF#G#
```

```
tc (Sm₁, Sm₂) = 5  tc (Sm₂, Dm) = 5
```