

harmony-analyser.org

Java Library and Tools for Chordal Analysis

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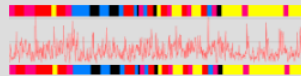
What is this library about?

- 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



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](#).

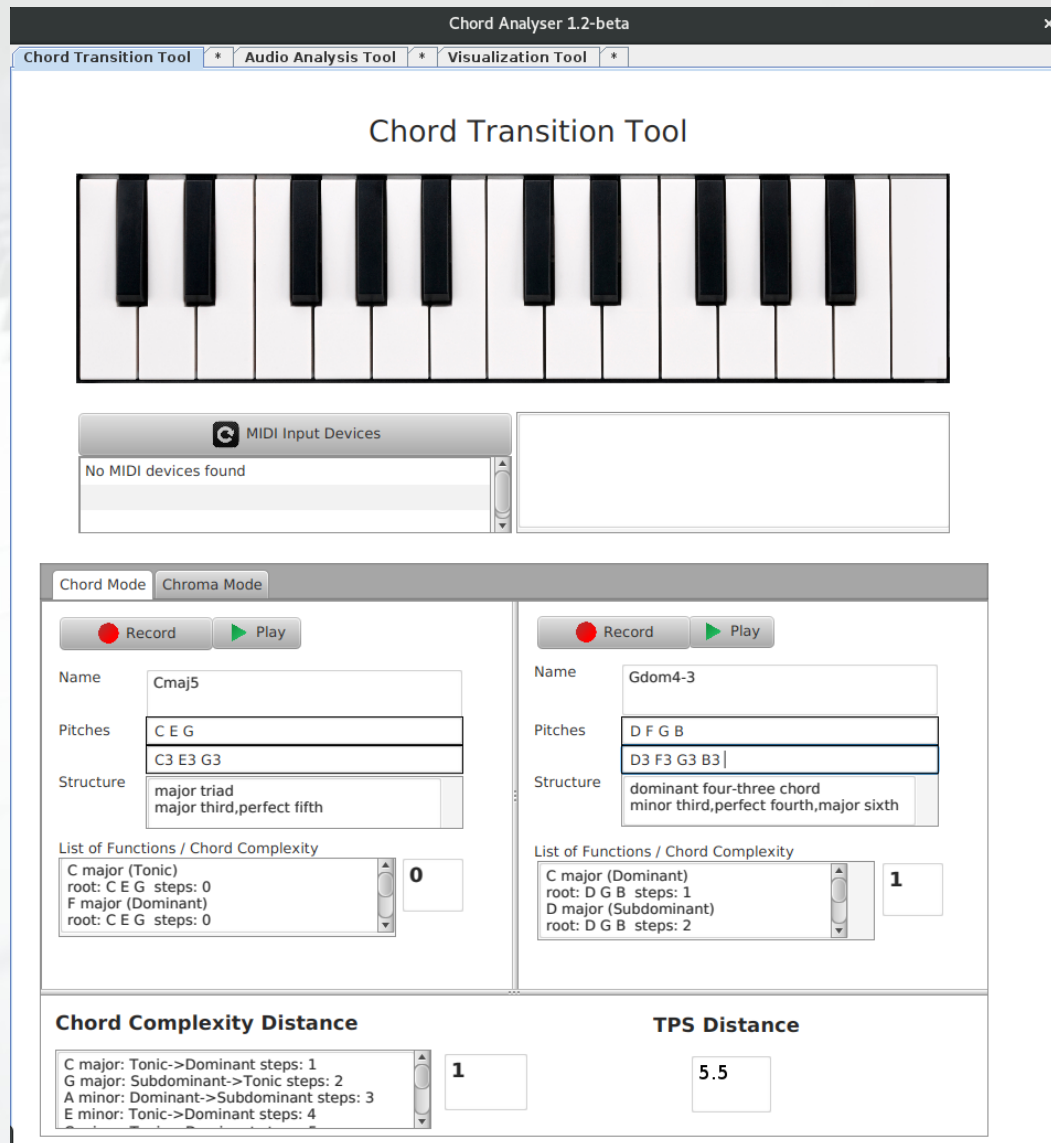
Tools are compatible with GPL Licensed [Vamp plugins](#) which can be used for additional analysis.

To contribute, please follow our guideline in [GitHub repository](#).

Releases

Please choose from the releases below:

Tools: Chord Transition Tool



Tools: Chord Transition Tool

Chord Mode

Chroma Mode

Record

Play

Name

Cmaj5

Pitches

C E G

C3 E3 G3

Structure

major triad
major third,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

0

Record

Play

Name

Gdom4-3

Pitches

D F G B

D3 F3 G3 B3

Structure

dominant four-three chord
minor third,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

1

Chord Complexity Distance

C major: Tonic->Dominant steps: 1
G major: Subdominant->Tonic steps: 2
A minor: Dominant->Subdominant steps: 3
E minor: Tonic->Dominant steps: 4

1

TPS Distance

5.5

Tools: Audio Analysis Tool

Audio Analysis Tool

Look In: Demo

Analysis

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

Beginning analysis: nnls-chroma:nnls-chroma
Input file(s):
/mnt/work/school/mff/Articles/WOCMAT2016/Demo/Analysis/PREP/HALLELUJAH-
Output file:
/mnt/work/school/mff/Articles/WOCMAT2016/Demo/Analysis/PREP/HALLELUJAH-
Wav file: HALLELUJAH-Alexandra_Burke-652946.wav
Sample rate: 44100.0
Channels: 2
Bytes per frame: 4
Output: Chromagram

VampChord AnalyserChroma AnalyserPost Processing

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

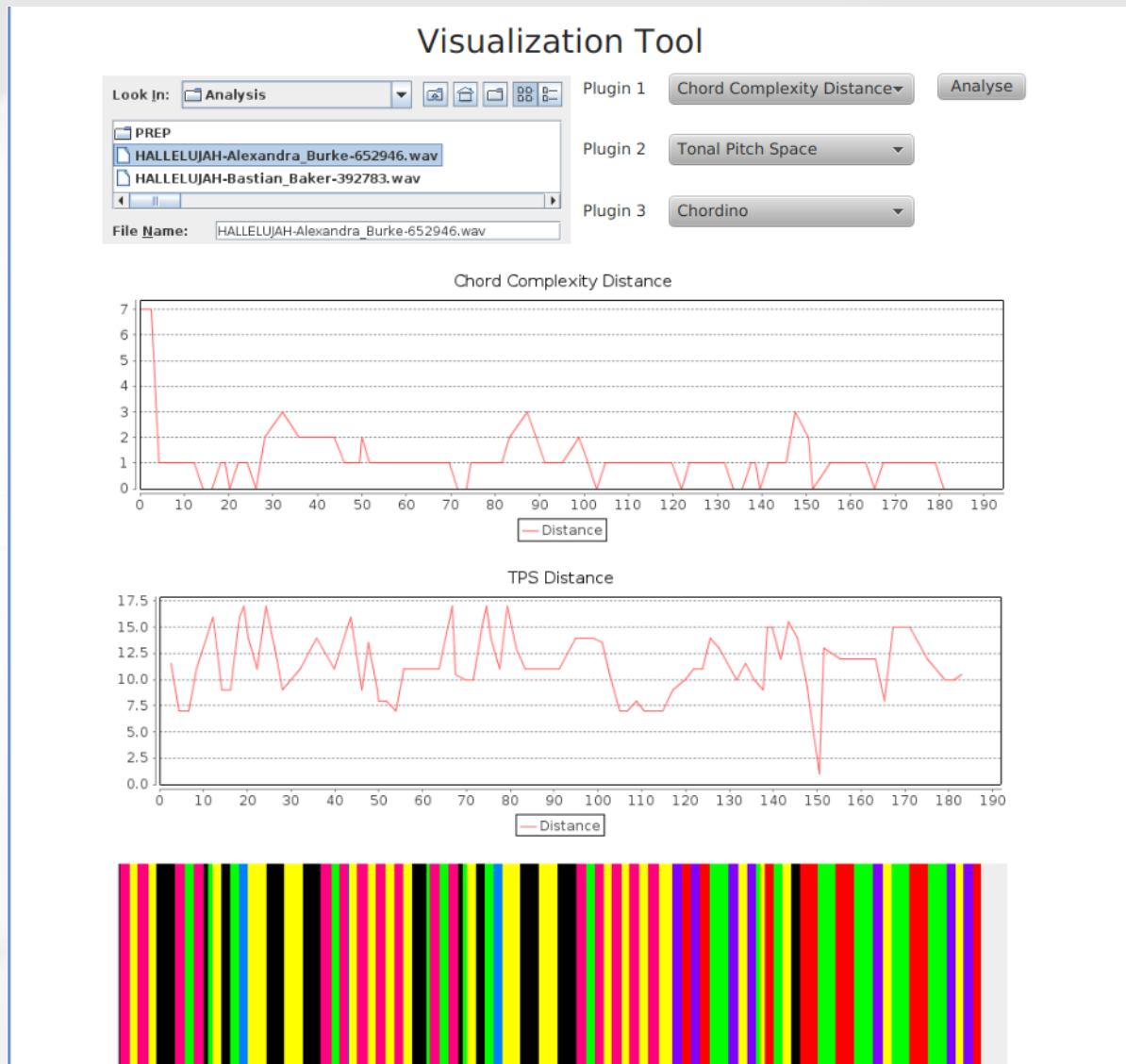
15: qm-vamp-plugins:qm-transcription

Chordino

Chordino VAMP Plugin

SettingsAnalyse

Tools: Visualization Tool



Chord Distances

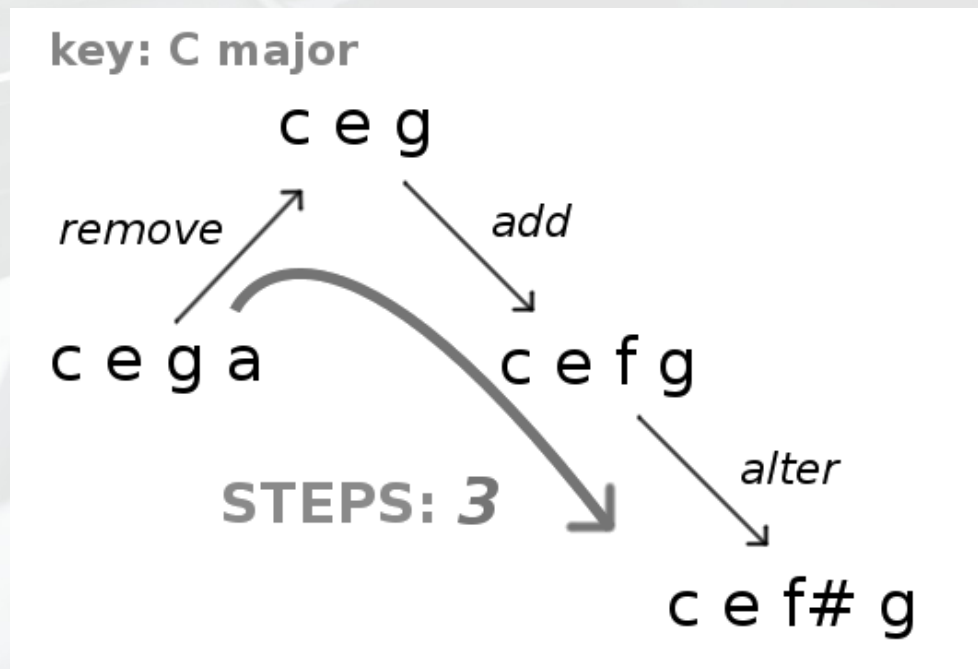
- Tonal Pitch Space (Fred Lerdahl)

TPS of C major chord in a C major key

<i>(a)</i>	0												(0)
<i>(b)</i>	0						7						(0)
<i>(c)</i>	0			4			7						(0)
<i>(d)</i>	0	2	4	5			7	9			11		(0)
<i>(e)</i>	0	1	2	3	4	5	6	7	8	9	10	11	(0)

Chord Distances

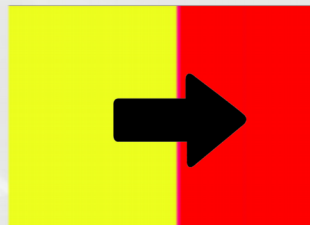
- Our novel concept: Chord Complexity Distance
(a variation of Edit Distance)



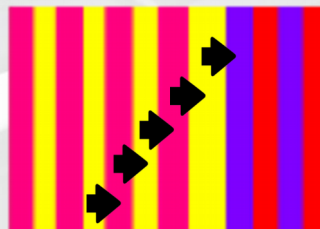
Experimental: Chroma Distances

- Idea: If chord distances work, why chroma distances shouldn't

Chord distance



Chroma distances



Experimental: Chroma Distances

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 :

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

Demo



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

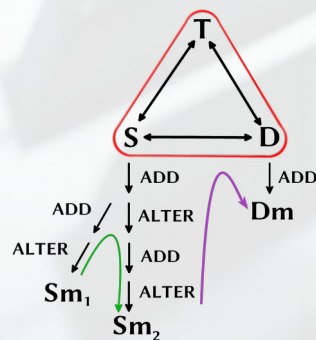
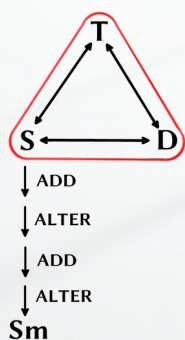
Thank you for your attention



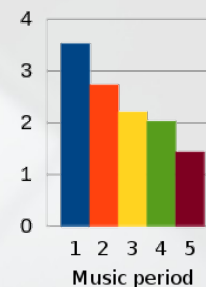
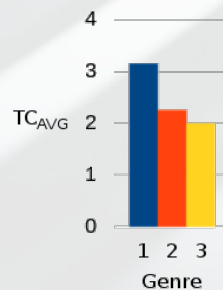
Additional Information: Model of harmonic complexity

- 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 $\xrightarrow{\text{ADD}}$ CEFG $\xrightarrow{\text{ALTER}}$ CEF#G $\xrightarrow{\text{ALTER}}$ CEF#G#



$$tc(Sm_1, Sm_2) = 5 \quad tc(Sm_2, Dm) = 5$$



1- 20th century
2- Romanticism
3- Classicism
4- Baroque
5- Renaissance