

# Evaluation of Set Class Similarity Measures for Tonal Analysis

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# Outline

- Introduction (explanation of the title)
- Objectives
- Methodology
  - Tonal Analysis
  - PC-set theory
  - Similarity Measures
  - Segmentation
- Visualisation
  - 3 techniques
- Analysis tool
- Conclusions

# Introduction

- Tonal Analysis
  - Model/describe tonal contents of music
  - look for patterns
- Pitch Class Set Theory
  - appropriate tool for descriptive modelling
- Similarity Measures
  - fundamental part of music
  - important for perception and visualisation

# Objectives

- Present a philosophy/methodology for study of tonality
- Develop visualisation techniques for interpreting data from music descriptions
- Demonstrate the analytical potential of similarity measures

# Tonal Analysis

## 1. Describe/model

- Describe what?
  - “The Musical Surface” (mid-level representation)
- Describe how?
  - Systematically

## 2. Find Patterns

- Visualise data
- Retrieve/augment traditional musicology

# PC-Set Theory

- What?
  - Tool for describing the musical surface
  - Pitches as numbers
  - Equivalence relations
- Why?
  - mid-level description
  - systematic
  - perceptually relevant

# PC Set Theory

- Basics
  - pitch class
  - pc set
  - set class
  - set class similarity

# SC Similarity Measures

- What?
  - Theoretical models of similarity
  - Many different models and approaches
- Why?
  - Musical similarity
  - Visualisation



# SC Similarity Measures

- Total Measures
  - Subset vector based
  - Consider subsets of all sizes
  - 6 total measures
  - Values for common chord comparisons (example plot)
    - what to look for?

# Pitch Class Set Analysis

- Basic principle
  - segment - describe - visualise
- Not much has been done
- Class Scape (A. Martorell)

# Segmentation

- Why is it important?
- Two segmentation policies
  1. Systematic (A. Martorell)
    - capture complete SC contents
  2. Sliding window
    - for “tuning-in” to a certain timescale
    - for visualisation

# Segmentation

- Complete SC contents example (Bach WTC MIDI)
  - class matrix
  - class vector
  - average SC segment length
  - average cardinality segment length
- Example plots

# Visualisation

- Distance Plot
- Autocorrelation
- Self-similarity matrix

# Visualisation

## **Distance Plot**

- What? - Distance time series from comparison set
- Why? - Visualise how the tonal content of the music change in time
- How?
  - segmentation selection
  - comparison set selection
- Example plot
- Peaks/interpretation
- Recurring patterns

# Visualisation

## **Autocorrelation**

- What? - Autocorrelation of the distance plot
- Why? - Peaks indicate repetitions in distance plot
- Example plot
- Peaks/interpretation

# Visualisation

## **Self-similarity matrix**

- What? - Each segment compared to every other
- Why? - Discover repetitions in time series
- Example plot
- Interpretation



# Analysis Tool

- What?
  - Interactive tool, integrating all techniques
- Why?
  - Many factors/parameters to consider
  - Exploration of the data is necessary
  - Compare use techniques together
- Demo

# Conclusions

- pc set theory:
  - a suitable descriptive tool
  - limitations
- similarity measures
  - analytical potential
  - limitations
- visualisation techniques
  - what information can they recover (musicological / intuition)
- Analysis tool
- Systematic mid-level descriptions are a starting point for many applications