PatternFinder: Content-based music retrieval with music21

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Symbolic Content-Based Music Retrieval (CBMR)

**Goal:** Given a query (pattern) of symbolic music, find all of the similar occurrences of this query within a database (source)

**Why:** Computer-aided musicology of symbolic music scores

**Challenges:**

- Application-dependent task
- Polyphonic music searching
PatternFinder

- Python package built on top of music21
- We started by implementing seven CBMR algorithms developed at the University of Helsinki (Kjell Lemström, Antti Laaksonen, Esko Ukkonen, Mika Laitinen)
- These algorithms find music similarity by trying to intersect sets of two-dimensional points
Piano-roll Example

Figure 1. A melody represented in common music notation.

Figure 2. An excerpt of Einojuhani Rautavaara’s opera *Thomas* (1985). Printed with the permission of the publisher Warner/Chappell Music Finland Oy.

Source
Excerpt from Schubert’s *Der Leiermann*

Queries

Threshold

- Minimum number of notes in the pattern which get mapped somewhere in the database
- Exact (every note is matched) or approximate (at least x pattern notes are matched)
- Or one can specify ‘mismatches’, meaning at most x pattern notes are missed
Threshold

Excerpt from Schubert's *Der Leiermann*

Queries B, D, and F require a threshold of at least 5 (or 85%)
Queries A, C, and E require a threshold of at least 6 (or 100%)
Scale

- Time-scaling liberties taken by the algorithm to find a match
- *Pure*: rhythmically identical occurrences
- *Scaled*: finds augmentation and diminution
- *Warped*: rhythmic values are ignored
Queries A and B require a scale of 1
Queries C and D require a scale of 3/2
Queries E and F require ‘warped’
Window

- Number of intervening notes allowed between two matched notes
- Pattern window
- Source window
All queries would require a source window of 4
Queries B, D, F need a pattern window of at least 2
Limitations and Future Work

- Ranking system
- Implementation of popular monophonic search methods (which are comparatively more effective than polyphonic-capable algorithms in their domains)
- Implement index and filtering methods for scalable database queries
SIMSSA: Single Interface for Music Score Searching and Analysis

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References


