Melodic Search:
Strategies and Formats

CS 275B/Music 254
Melody: preliminaries

- What is a theme?
- What is an incipit?
- Are all themes incipits?
- Can you tell the key from a melody?
- Can you tell whether something you hear begins at the beginning?
- Is melody one-dimensional?
- How can we isolate a melody algorithmically?
Literal search

Intervallic search

Scale-degree search

Gross contour

Refined contour

Filters:

- key
- mode
- meter

Sponsored by the
Center for Computer Assisted Research in the Humanities
Imported search strategies
Search strategies imported from other fields

- Probability ranking (statistics)
- Sorting, clustering (CS plus….)
- String matching, edit distance (industrial psychology)
- N-grams (computational linguistics; unix sort)*
- Dynamic programming (mathematics, optimization)
- Pattern detection (engineering, AI)
- Classification (statistics, machine learning)

*See Google N-gram Viewer: https://en.wikipedia.org/wiki/Google_Ngram_Viewer
Melodic sorting (incipits)

Examples from RISM

Edit distance: textual example

1. Item-by-item comparison
2. Penalties for
   • substitutions
   • insertions
   • deletions

Bag
Bat
Cat
Catch
Lemstrom, Pienimäki (2007)

“Edit distance vs geometric methods”
For music, Musica Scientiae

Ex: opera Thomas (1985) by Rautavaara

When the music at hand does not contain clear voicing, but it is rather perceived as a progression of chords, forcing the musical data into monophonic voices may result in a musically meaningless representation. Moreover, a pragmatic problem is that the representation does not support the problem depicted in Figure 2.b, where one wishes to find occurrences of the query pattern that may be distributed across the voices of the score.

Non-interleaved, interleaved encodings (MIDI)
**N-grams**

Beethoven: Archduke Trio

**Method**
Pick a string length
Seek all its permutations
The first line tells us that in 1834, the melody occurred 94 times overall.

The format of the total counts file is identical, except that the ngram field is absent; there is only one value match_count per year.

Inside each file the ngrams are sorted alphabetically and then chronologically.
Pattern detection
Pattern detection

Settings of the word "Liebe"

Nettheim: MuSearch (SCORE)

Pattern realms
- Lyrics
- Pitch
- Duration
- Phrase structure
Vulnerabilities: Length of query

Query

Target (scale degree): 32123

Pitch (scale-degree) matching without *rhythmic, metric invariance*
Vulnerabilities: Directional information, rhythm

Query

Target: 3331

Pattern-matching without:
- **Rests**
- **Register considerations**
- **Repeated notes**
Themefinder

A search application for melodic data
Classical = themes
Folk = incipits
Renaissance = incipits
Search examples

...in decreasing order of precision

pitch: D A G F E D D D D D D D C#
interval: +P5 -M2 -M2 -m2 -M2 +P8 P1 P1 P1 P1 P1 -m2
scale degree: 1 5 4 3 2 1 1 1 1 1 1 1 7
gross contour: / \ \ \ \ / - - - - - 
refined contour: U d d d d U s s s s s s s d

http://www.themefinder.org
Thought for the day

“The dictionary describes melody as a series of notes strung together in a meaningful sequence.”

Source: U.S. Patent application 20060254411 (Nov. 16, 2006)

To be continued…