Melodic Search: Strategies and Formats

CS 275B/Music 254
On melody

- 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?
On melody

- What is a **theme**? Significant content that identifies a piece
- What is an **incipit**? Opening phrase
- Are all themes incipits? **No**
- Can you tell the key from a melody? **Sometimes**
- Can you tell whether something you hear begins at the beginning? **??**
- Is melody one-dimensional?
- How can we isolate a melody algorithmically?
Imported search strategies
Imported search strategies

- Probability ranking
- Sorting, clustering, categorization
- String matching, edit distance
- N-grams
- Dynamic programming
- Pattern detection
Probability ranking


Example: MELDEX
Melodic sorting (incipits)

Examples from RISM

Edit distance: text

1. Item-by-item comparison

2. Penalties for
   - substitutions
   - insertions
   - deletions

<table>
<thead>
<tr>
<th>Bag</th>
<th>Bat</th>
<th>Cat</th>
<th>Catch</th>
</tr>
</thead>
</table>

Target = bag

Matches = bag, Bag, BAG
Non-matches [different order] = gab, abg, bga

Direction of comparison = L → R
Match = L → R
Non-matches [different direction] = R → L; T → B; B → T; ZZ

Literal content required for match = bag
Matches = baggage, cabbage
Non-matches [different literal content] = beagle, bang, bad and good
Edit distance (music)

Ambiguities
- iteration (accent invariant)
- polyphonic involvement
- decoration (accent invariant)

Target = b a g

Sound matches:

Symbolic matches:
N-grams

Beethoven: Archduke Trio

Method
Pick a string length
Seek all its permutations
N-grams

IMSLP Music Search by Peachnote

Please enter a melody or a sequence of chords (advanced use)

Computer Music Library
Smoothing
Normalized

New search results (e.g. Mozart, waltz, or quartet)

6 Capriccio, Op. 27
Kreutzer, Theodor (1777)

6 Fantasies
Bach, Johann Sebastian (1722)

Piano Trios
Mozart, Gabriel (1820)

Beethoven, Ludwig Van (1820)

Piano Trios
Mozart, Gabriel (1820)

Antigone
Mestrodosthi, Felix (1941)

Guido Cesarini (1870)

Handel, George Frideric (1724)

The Nutcracker
Tchaikovsky, Pyotr (1847)

Symphony no. 8 in D minor
Beethoven, Anton (1806)

Duke University Library Music Search by Peachnote

Please enter a melody or a sequence of chords (advanced use)

Keyboard shortcuts

New search results (e.g. Mozart, waltz, or quartet)

My old home and friends
Cory Brothers (1779)

Huckleberry Finn cake walk; Two-step
Jos. Morris (1800)

Fishing for the moon; Green bird
Kemp Music (1897)

Mary's ragtime waltz
Sam Fox (1812)

Dreaming dreams of you
Hamilton & Gordon (1813)

Down among the sheltering palms
Leo Feist (1877)

When the good Lord makes a record of a person's
M. Wilmark & Sons (1918)

dead, he draws no color line

and

you can also browse using the chart
Dynamic programming

Example: 2 performances of Beethoven’s
*Symphony No. 5*

- von Karajan
- Kleiber

Performance-based self-similarity matrices

Examples: Jonathan Foote

Example: Bach

- Glenn Gould
- MIDI

Rhythmic similarity
Pattern detection
Pattern detection

Settings of the word "Liebe"

Nettheim: MuSearch (SCORE)

Pattern realms
- Lyrics
- Pitch
- Duration
- Phrase structure

D795/6 Der Neugierige
O B ch - lein mei-ner Lie- be, wie bist du heut’ so stumm!

D795/9 Des M üllers Blumen
der. Bach, der ist des M üllers Freun-d und hell blau Liebchen Au - ge scheint,

D795/12 Pause
Ist es der Nach - klang mei-ner Lie - bes - pein?

D795/19 Der M üller und der Bach
acht, B ch - lein, a - ber weisst du wie Lie - be schüt? -
Vulnerabilities

Query

Target (scale degree): 32123

Pitch (scale-degree) matching without rhythmic, metric invariance
Vulnerabilities

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)