Melodic Search: Strategies and Formats

CS 275B/Music 254

Melody

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
- What is an incipit? Beginning 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? Sometimes
- Is melody one-dimensional? Most of the time
- How can we isolate a melody algorithmically? ???
- *

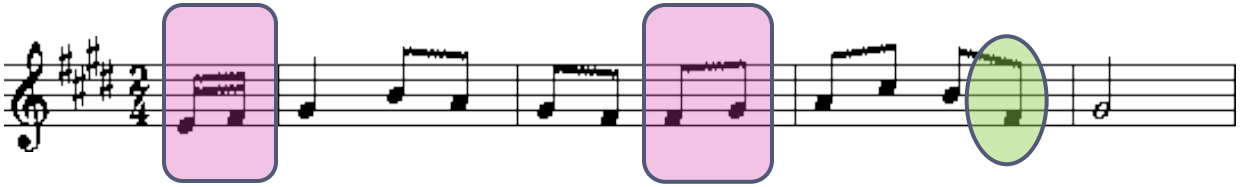
Musical similarity (in general)

Kinds of musical similarity

- Librarians: titles, metadata (rism)
  - Meter
  - Mode
- Cognitive psychologists: weighted features
  - Duple vs triple vs other meter
- Audio engineers, recommendation services:
  - Affect: Crosses repertories in bizarre ways
  - Timbre:
  - Dynamics:
  - Tempo:
- Ear-worms: attentional elements

What is an attentional feature?

- Anything unexpected event
  - An atypical duration
  - An atypical pitch
  - A sudden change in tempo
  - A sudden change of register



Beethoven

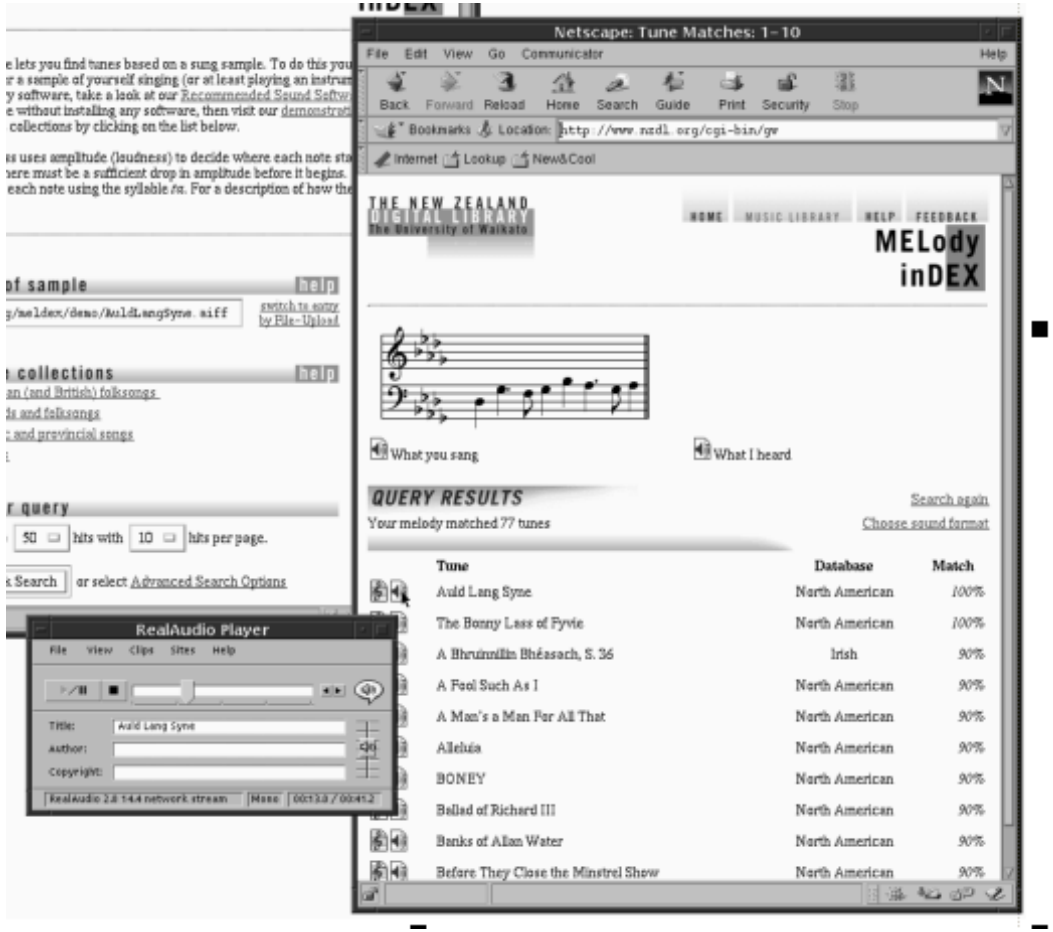
Non-musical search strategies

Non-musical search strategies

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

Probability ranking (L. Smith, 1995)

"Query-by-humming": work of Lloyd Smith et al, *c*. 1995.

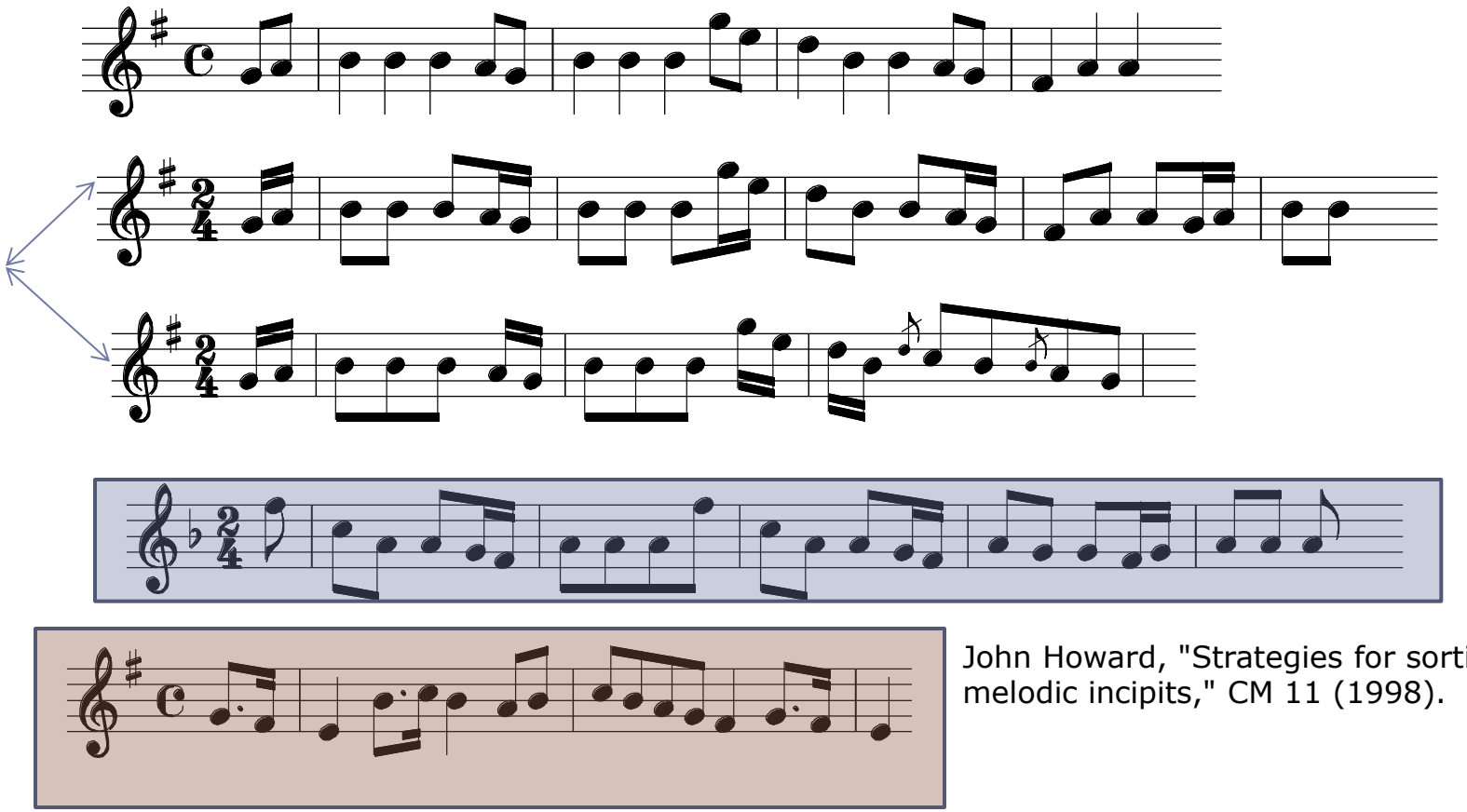


Example: MELDEX

Melodic sorting (Schlichte, 1997)

[Ranking??]

Examples from RISM



John Howard, "Strategies for sorting melodic incipits," CM 11 (1998).

Edit distance: text

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

Bag

Bat

Cat

Catch

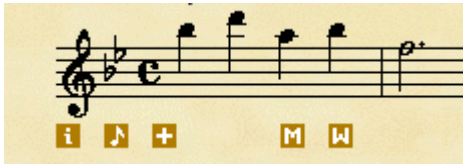
Target=bag

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

N-grams

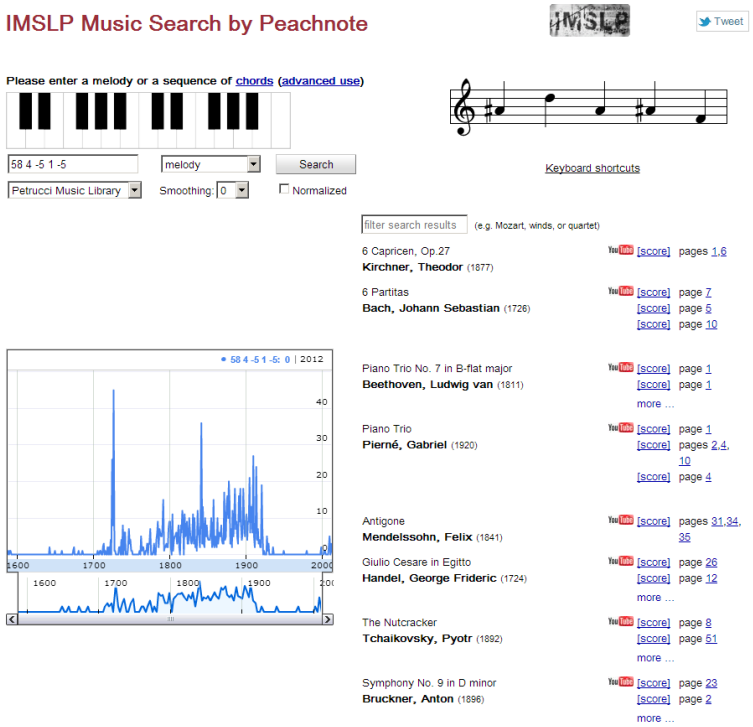


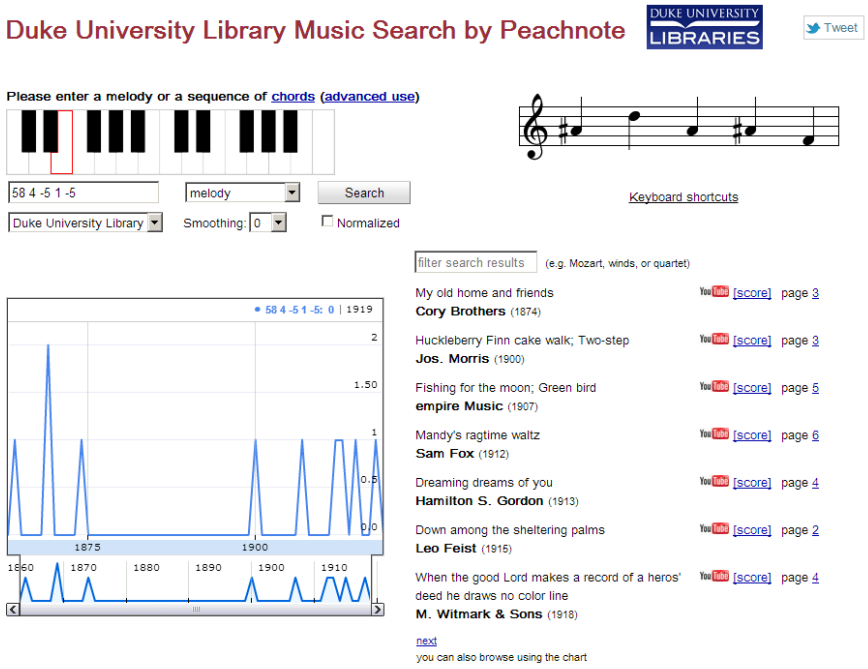
Beethoven: Archduke Trio

Method

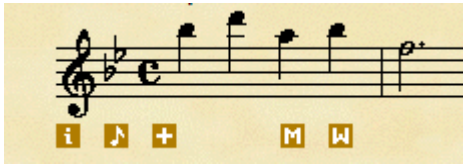
Pick a string length

Seek all its permutations



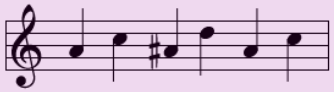


N-grams (Vero)



Music n-gram viewer

http://www.peachnote.com/datasets.html



The first line tells us that in 1804, the melody occurred 94 times overall.

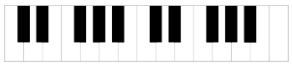
The format of the total counts file is identical, except that the `ngram` field is absent: there is only one value match_count per year.

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

IMSLP Music Search by Peachnote

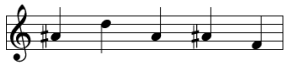
Tweet

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



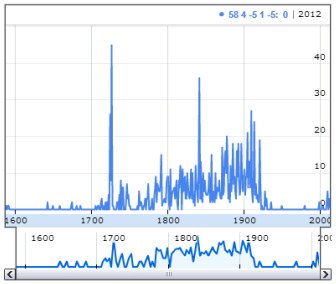
58 4 -5 1 -5 | melody | Search

Petrucci Music Library | Smoothing: 0 | Normalized



Keyboard shortcuts

filter search results (e.g. Mozart, winds, or quartet)



6 Capricen, Op.27 — **Kirchner, Theodor** (1877) — [score] pages 1,6

6 Partitas — **Bach, Johann Sebastian** (1726) — [score] page 7, [score] page 5, [score] page 10

Piano Trio No. 7 in B-flat major — **Beethoven, Ludwig van** (1811) — [score] page 1, [score] page 1, more …

Piano Trio — **Pierné, Gabriel** (1920) — [score] page 1, [score] pages 2,4, 10, [score] page 4

Antigone — **Mendelssohn, Felix** (1841) — [score] pages 31,34, 35

Giulio Cesare in Egitto — **Handel, George Frideric** (1724) — [score] page 26, [score] page 12, more …

The Nutcracker — **Tchaikovsky, Pyotr** (1892) — [score] page 8, [score] page 51, more …

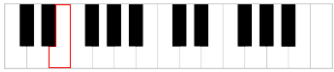
Symphony No. 9 in D minor — **Bruckner, Anton** (1896) — [score] page 23, [score] page 2, more …

Duke University Library Music Search by Peachnote

DUKE UNIVERSITY LIBRARIES

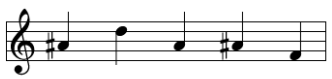
Tweet

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

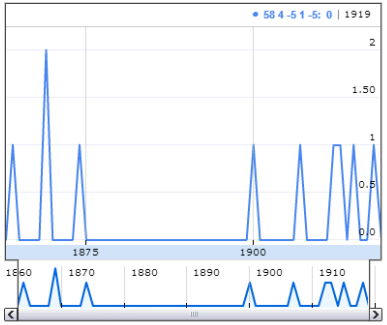


58 4 -5 1 -5 | melody | Search

Duke University Library | Smoothing: 0 | Normalized



Keyboard shortcuts



filter search results (e.g. Mozart, winds, or quartet)

My old home and friends — **Cory Brothers** (1874) — [score] page 3

Huckleberry Finn cake walk; Two-step — **Jos. Morris** (1900) — [score] page 3

Fishing for the moon; Green bird — **empire Music** (1907) — [score] page 5

Mandy's ragtime waltz — **Sam Fox** (1912) — [score] page 6

Dreaming dreams of you — **Hamilton S. Gordon** (1913) — [score] page 4

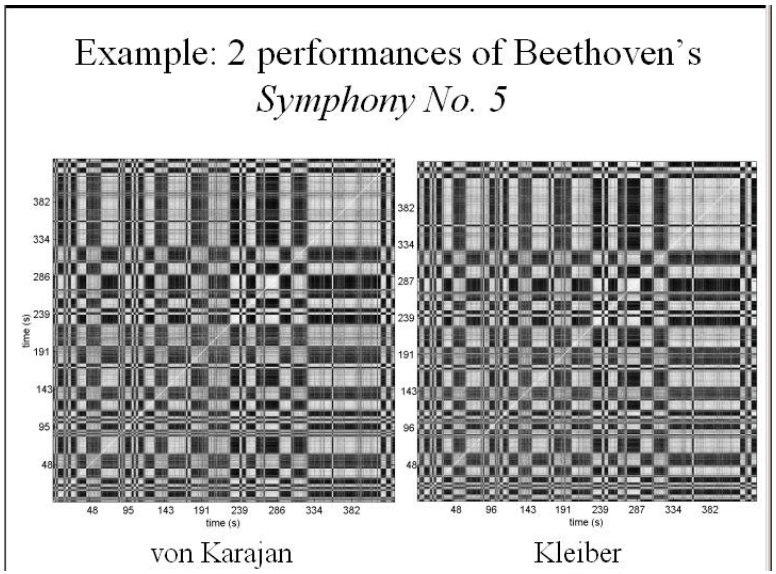
Down among the sheltering palms — **Leo Feist** (1915) — [score] page 2

When the good Lord makes a record of a heros' deed he draws no color line — **M. Witmark & Sons** (1918) — [score] page 4

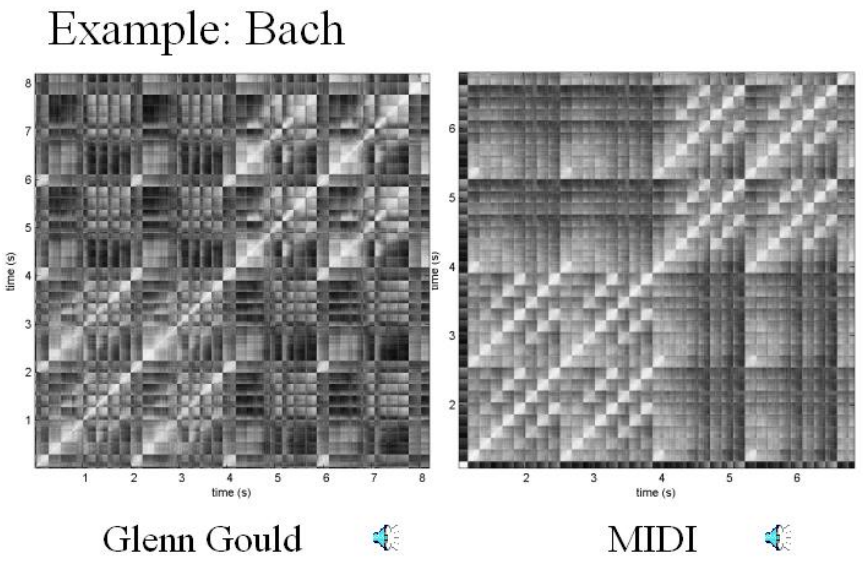
next

you can also browse using the chart

Dynamic programming (Foote, 2002)



Examples: Jonathan Foote



Performance-based

self-similarity matrices

Rhythmic similarity

Pattern detection

Pattern detection: parameters

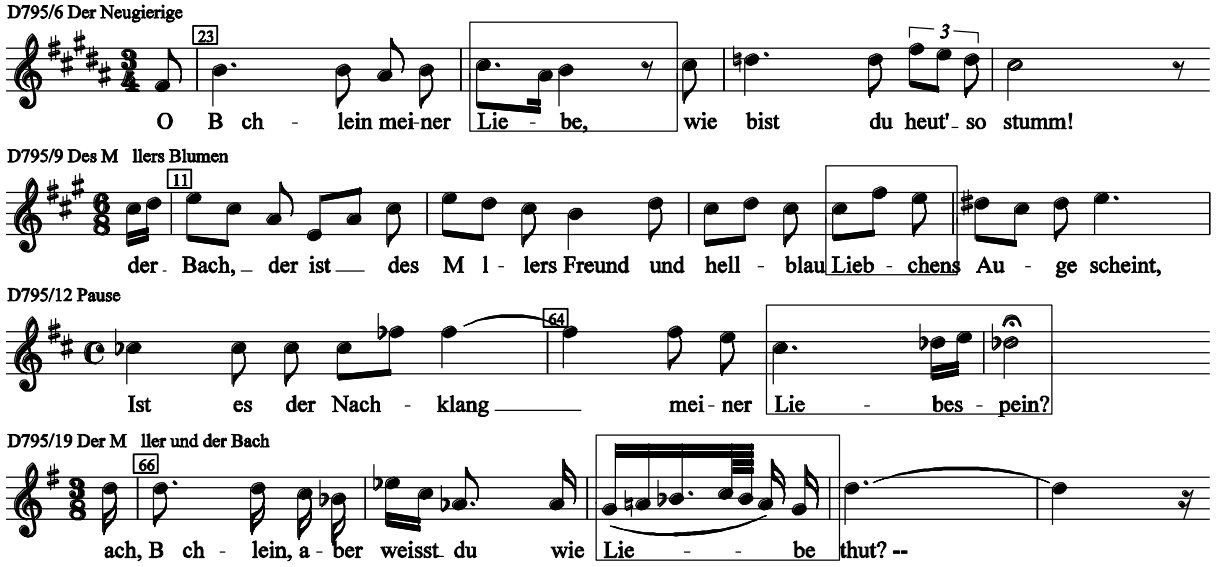
- **Types**
  - Rhythmic cells
  - Melodic cells
  - Word-tone relations

- **Confounds**
  - Boundary issues
  - "Noise" issues
  - … many more

Pattern detection: word-tone

Settings of the word "Liebe"

Nettheim: MuSearch (SCORE)

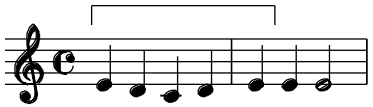


Pattern **realms**

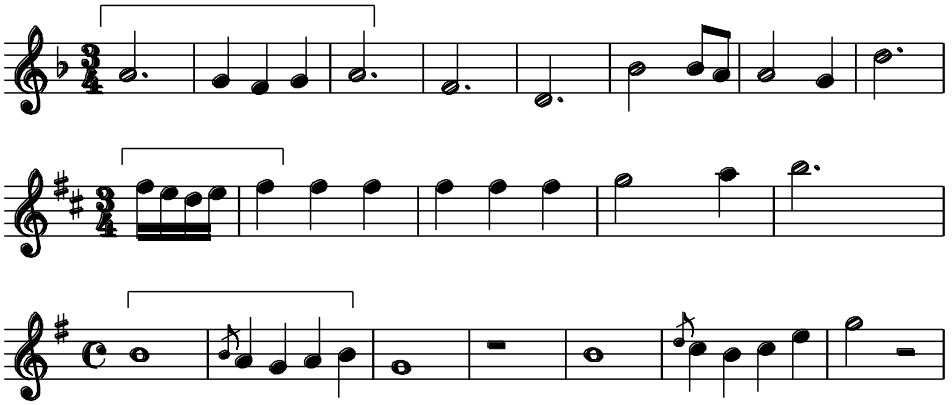
- Lyrics
- Pitch
- Duration
- Phrase structure

Vulnerabilities: rhythms differentiate melodies

Query



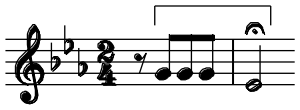
Target (scale degree): 32123



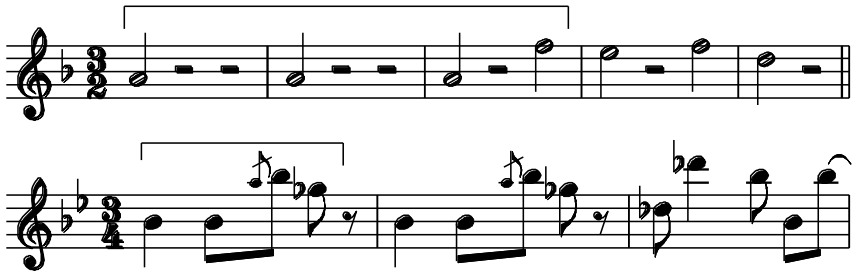
Pitch (scale-degree) matching without **rhythmic, metric invariance**

Vulnerabilities: register confounds

Query



Target: 3331



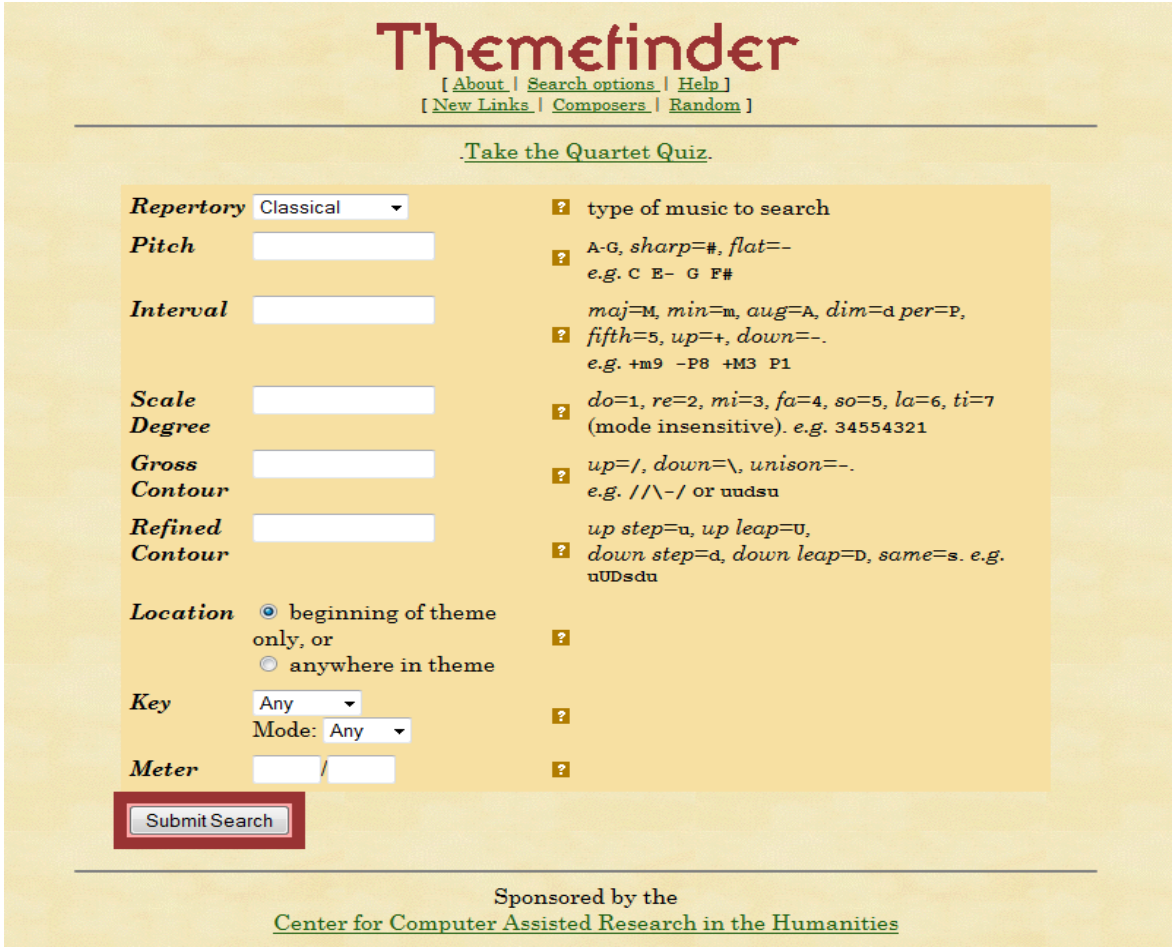
Pattern-matching without:

- **R**ests
- **R**egister considerations
- **R**epeated notes

Themefinder

A search application for melodic data

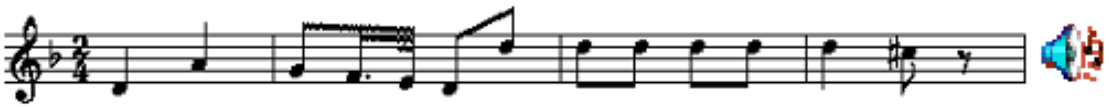
Themefinder (themefinder.org)



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 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)