Humdrum Tools II

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Melodic Searching

\texttt{tindex – themax – theloc}

Download data files for J.S. Bach chorales:
\texttt{humsplit h://371chorales}

Create \textit{thema} search index:
\texttt{tindex *.krn > index.dat}

Search for the pitch sequence "c d e f g a b":
\texttt{themax –p "c d e f g a b" index.dat --loc}
\begin{itemize}
  \item chor190.krn::1  48-54 58-64
  \item chor325.krn::1  17-23
\end{itemize}

Convert matched note numbers into measure/beat locations:
\texttt{themax –p "c d e f g a b" index.dat --loc | theloc}
\begin{itemize}
  \item chor190.krn::1  48=9B1-54=9B4 58=10B2-64=11B2.5
  \item chor325.krn::1  17=5B1-23=6B3
\end{itemize}

http://extras.humdrum.org/man/tindex (themax, theloc)
Marking search in data

chor190.krn::1
48=9B1-54=9B4
58=10B2-64=11B2.5

Chorale 190, first **kern spine (bass part)
First match on notes 48-54 which is in measure 9
starting on beat one and ending at beat 4.
Second match on notes 58-64 starting at m10 beat 2
and ending at m11 beat 2.5

Marking match in original data:

themax –p “c d e f g a b” index.dat --loc | theloc –m

(only first entry in themax results will be processed)

@ sign is a “user-definable signifier”
!!!RDF**kern: @= matched note
Displaying matches in graphical notation

themax –p “c d e f g a b” index.dat --loc | head –n1 | theloc –m | myank –m 9-11 > match.krn

cat match.krn | autostem | hum2muse | muse2ps =z21j | pstopnm -dpi=300 \ |
convert - -trim -resize '33%' match.png

Herr, nun laß in Friede

J.S. Bach

themax –p “c d e f g a b” index.dat --loc | head -n1 | theloc -m | myank --marks > match.krn
Parallel feature searching

Search for the pitch sequence “cdefgab” only going upwards:

```
themax -p "cdefgab" -C "uuuuuu" index.dat --loc
   chor190.krn::1  48-54
   chor325.krn::1  17-23
```

Pitch: cdefgab
Contour: up up up up up up

Prevent matches across fermatas:

```
tindex --fermata *.krn > index2.dat
themax -p "cdefgab" index2.dat --loc
   chor190.krn::1  48-54
   chor325.krn::1  17-23
```
Josquin Research Project website

- front-end for tindex/themax/theloc
http://josquin.stanford.edu

Sample Work: Ockeghem, Salve regina I

Search

Enter Pitch

Enter Interval

Enter Rhythm

Interval: -I
Rhythm: -u

themax input fields

-D option
(diatonic search ignoring accidentals)
JRP Search Results

search results for diatonic pitch sequence “cdefgab”:

<table>
<thead>
<tr>
<th>Match Locations</th>
<th>Composer</th>
<th>Title</th>
<th>Voices</th>
<th>Scores</th>
<th>MP3</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Josquin</td>
<td>Magnificat quarti toni</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Josquin</td>
<td>Missa est Gabriel</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Josquin</td>
<td>Responsum acceperat Simeon</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Josquin</td>
<td>Tulerunt Dominum</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Josquin</td>
<td>Verbum caro factum est</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Josquin</td>
<td>Ave verum corpus</td>
<td>2-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Josquin</td>
<td>Ave verum corpus</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Josquin</td>
<td>Magnus es tu, domine</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Josquin</td>
<td>Victimae paschali laudes</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Josquin</td>
<td>Ave maris stella</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Josquin</td>
<td>Monstra te esse matrem</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Josquin</td>
<td>Ave virgo sanctissima</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Josquin</td>
<td>Nesciens mater virgo</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Josquin</td>
<td>Regina celi letare</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Josquin</td>
<td>Regina celi letare</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Josquin</td>
<td>Salve regina</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Josquin</td>
<td>Stabat mater/Comme femme</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Josquin</td>
<td>Gloria laus et honor</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Josquin</td>
<td>Sancta trinitas</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Josquin</td>
<td>Cela sans plus</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

count and location of matches within score
Graphical display of search results

- Click on location thumbnail to view score with matches highlighted:
Themefinder/Kernscores

Search Engine

Score Database
Harmonic searching

Are there more major or minor sonorities in Bach chorales:

```
tntype *.krn | grep 3-11A | wc –l 5225
```

```
tntype *.krn | grep 3-11B | wc –l 10625
```

3-11 == “Forte number”: 3 pitch classes in the 11th most compact configuration.

3-11A = most compact inversion of pitch classes (minor triad)
3-11B = least compact inversion of pitch classes (major triad)

In minor keys, are the more major or minor sonorities:

```
tntype `egrep '^[a-g].?:' *.krn` | grep 3-11A | wc –l
```

```
tntype `egrep '^[a-g].?:' *.krn` | grep 3-11B | wc –l
```
Search for parallel 6ths in Bach chorales:

```
cint h://370chorales --raw -Uo | grep '^6.*6$' | sortcount -pt
```

- `-U` = don’t extract repeated noted modules
- `-o` = collapse compound intervals to within an octave (octave + 6\textsuperscript{th} $\rightarrow$ 6\textsuperscript{th})
- `--raw` = output modules, don’t embed within score

http://extras.humdrum.org/man/cint/
What is the most common parallel motion?

```bash
for var in `seq 1 8`
do
echo Number of parallel motions for $var:
cint *.krn --raw -Uo | grep "^$var.*$var$" | wc -l
done
```

Bach Chorales:

- Number of parallel motions for 1: 2
- Number of parallel motions for 2: 22
- Number of parallel motions for 3: 5437
- Number of parallel motions for 4: 1950
- Number of parallel motions for 5: 135
- Number of parallel motions for 6: 4890
- Number of parallel motions for 7: 35
- Number of parallel motions for 8: 9

Total number of modules:  cint *.krn --raw -Uo | wc -l  69418
18% of music involves parallel motion
Cint searching

cint --search "7xs 1 6sx -2 8xx" -x -n 2 jrp://Bus1001a

| myank –m 7-8 | hum2muse | muse2ps =z21j

-x: add attack states
-n2: 2 module chain
chorck

http://extras.humdrum.org/man/chorck

chorck h://371chorales/chor008.krn -w

3. Contrary parallel 5th between tenor and soprano on line 26
3. Contrary parallel 5th between tenor and soprano on line 40
3. Contrary parallel 5th between tenor and soprano on line 52
5. Hidden 5th between soprano and alto on line 54
5. Hidden 5th between soprano and bass on line 54
5. Hidden 5th between soprano and tenor on line 70
5. Hidden 5th between soprano and bass on line 70
5. Hidden 5th between soprano and tenor on line 85
8. Open spacing between alto and tenor on line 120
8. Open spacing between alto and tenor on line 121
3. Contrary parallel 5th between tenor and soprano on line 125
5. Hidden 5th between soprano and tenor on line 137
5. Hidden 5th between soprano and tenor on line 146
7. Voice crossing between tenor and bass on line 154
8. Open spacing between alto and tenor on line 154
7. Voice crossing between tenor and bass on line 155
8. Open spacing between alto and tenor on line 155

Like “proof”: checks data semantics
Freue't euch, ihr Christen alle

J.S. Bach
JRP Analysis Tool: dissonant

dissonant jrp://Jos2721 | myank –m 10-15

http://josquin.stanford.edu/data?a=dissonantpdf&f=Jos2721-La_Bernardina

http://museinfo.sapp.org/examples/humdrum/dissonant.cpp
Freuet euch, ihr Christen alle

J.S. Bach

dissonant

dissonant h://371chorales/chor008.krn | extractx -i**kern' | satb2gs | autostem | \ hum2muse | muse2ps =z14jv120,100 | pstopnm -dpi=300 | convert - -trim output.png
8. Freuet euch, ihr Christen alle

Johann Sebastian Bach
dissonant/abcm2ps

dissonant h://371chorales/chor008.krn | extractx -i'**kern' | myank -m13-15 | satb2gs \
| hum2abc | abcm2ps - -O - | pstopnm -dpi=300 | convert - -trim output.png

8. Freuet euch, ihr Christen alle

Johann Sebastian Bach

4th below tenor
2nd below alto
2nd above soprano
JRP Analysis Tool: parallel


for i in `seq -w 371`
do
echo \!\!chorale $i
parallel -l h://371chorales/chor$i.krn
done | less

parallel h://371chorales/chor008.krn | autostem | hum2muse | muse2ps =z6j \ | pstopnm -dpi=300 | convert - -trim output.png