The SIMSSA Project: Search as access to digital music libraries

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Workshop on SIMSSA XV, IAML, Leipzig, 28 July 2018

SIMSSA | Single Interface for Music Score Searching and Analysis

- SSHRC Partnership Grant (2014-2021)
- PI: Ichiro Fujinaga (McGill University)
- Partners include the British Library, Bodleian Libraries at Oxford, Bibliothèque Nationale de France, Bavarian State Library, New York Philharmonic Archives, Alexander Street Press, RILM, and RISM Switzerland among others

How it works:

1. Library digitizes scores
2. Optical Music Recognition
3. Symbolic Encoding with MEI
4. Search and Analysis

- How do we access the scores?
- How can we teach computers to read musical scores?
- How will music search and analysis work?

How do we access the scores?

International Image Interoperability Framework

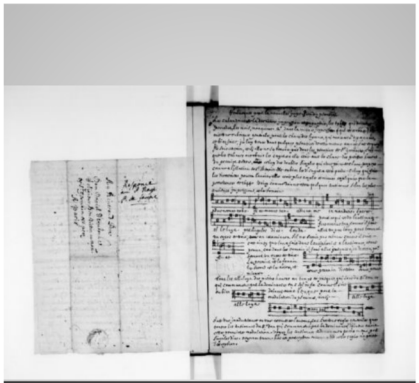
MusicLibs.net

Search

Search 67323 documents from 12 sources.

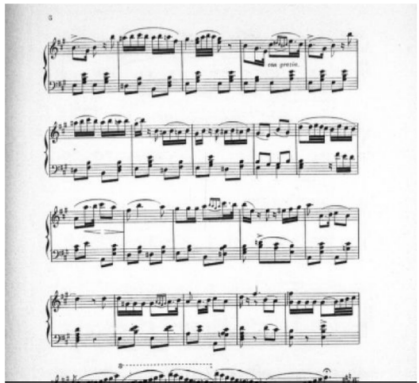
>> Pitch Search (Experimental)

Selected items



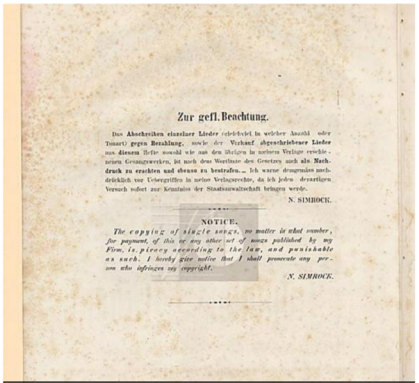
Français 20000

Bibliothèque nationale de France



N-13752

Bibliothèque nationale de France



2 Songs, Op.91

The Internet Archive

About DDMAL DISTRIBUTED DIGITAL MUSIC ARCHIVES & LIBRARIES LAB SIMSSA Single Interface for Music Score Searching and Analysis

How can we teach computers to read musical scores?

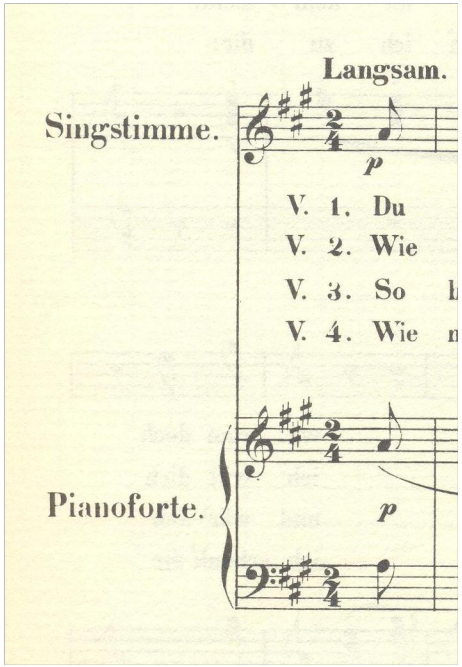
Optical Character Recognition

- Makes images of text machine-readable
- XML

Optical Music Recognition

- Makes images of sheet music machine-readable
- MIDI, MusicXML, MEI

Music Encoding Initiative (MEI)

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              <staffDef n="3" lines="5" clef.shape="F" clef.line="4"/>
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      </score>
    </mdiv>
  </body>
</music>
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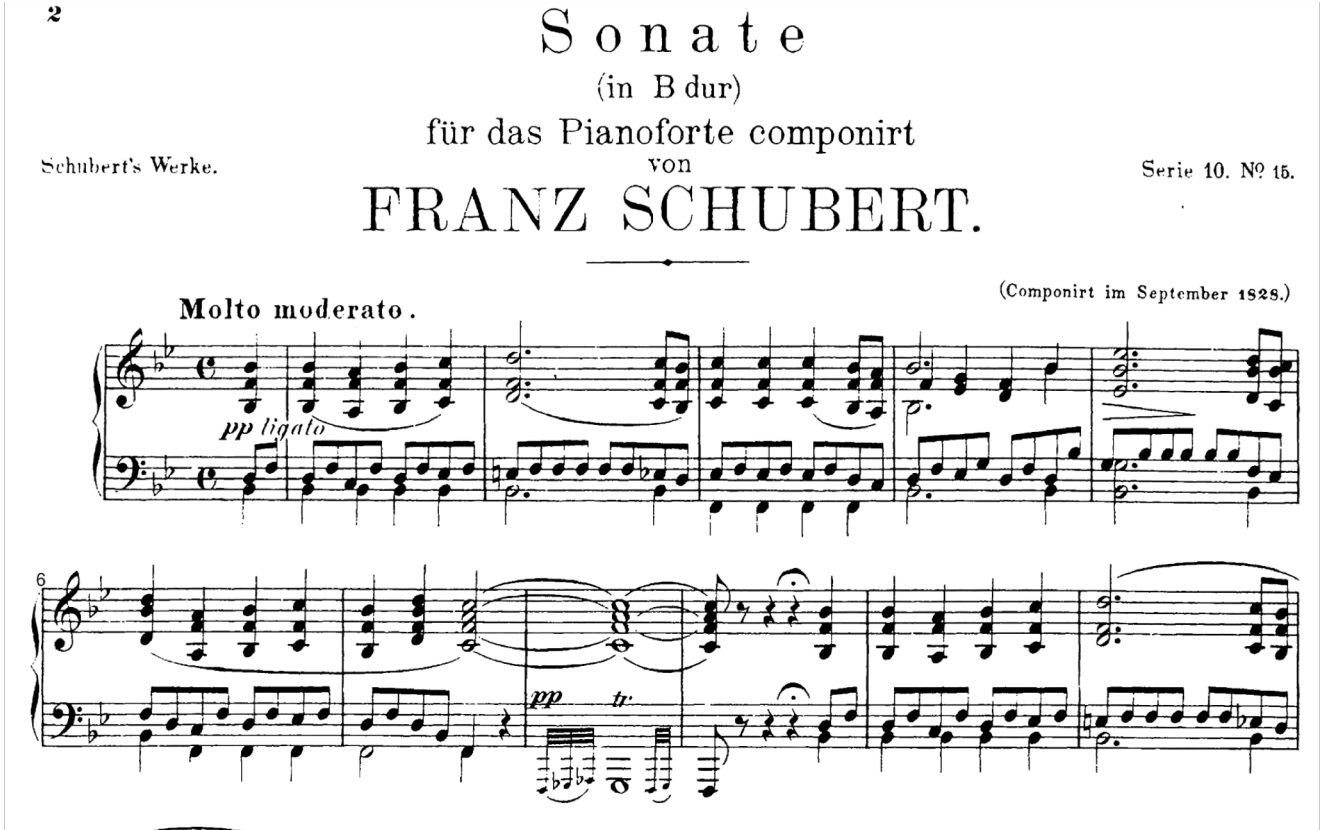
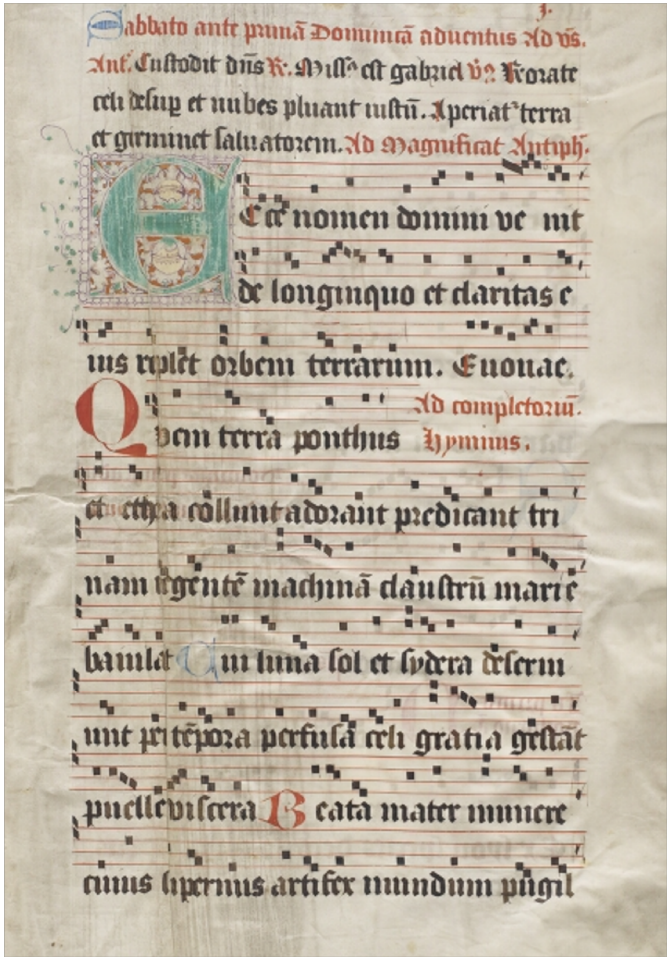
Example borrowed from the MEI tutorial at music-encoding.org; music is Robert Schumann's *Der Abendstern.*

Commercial OMR

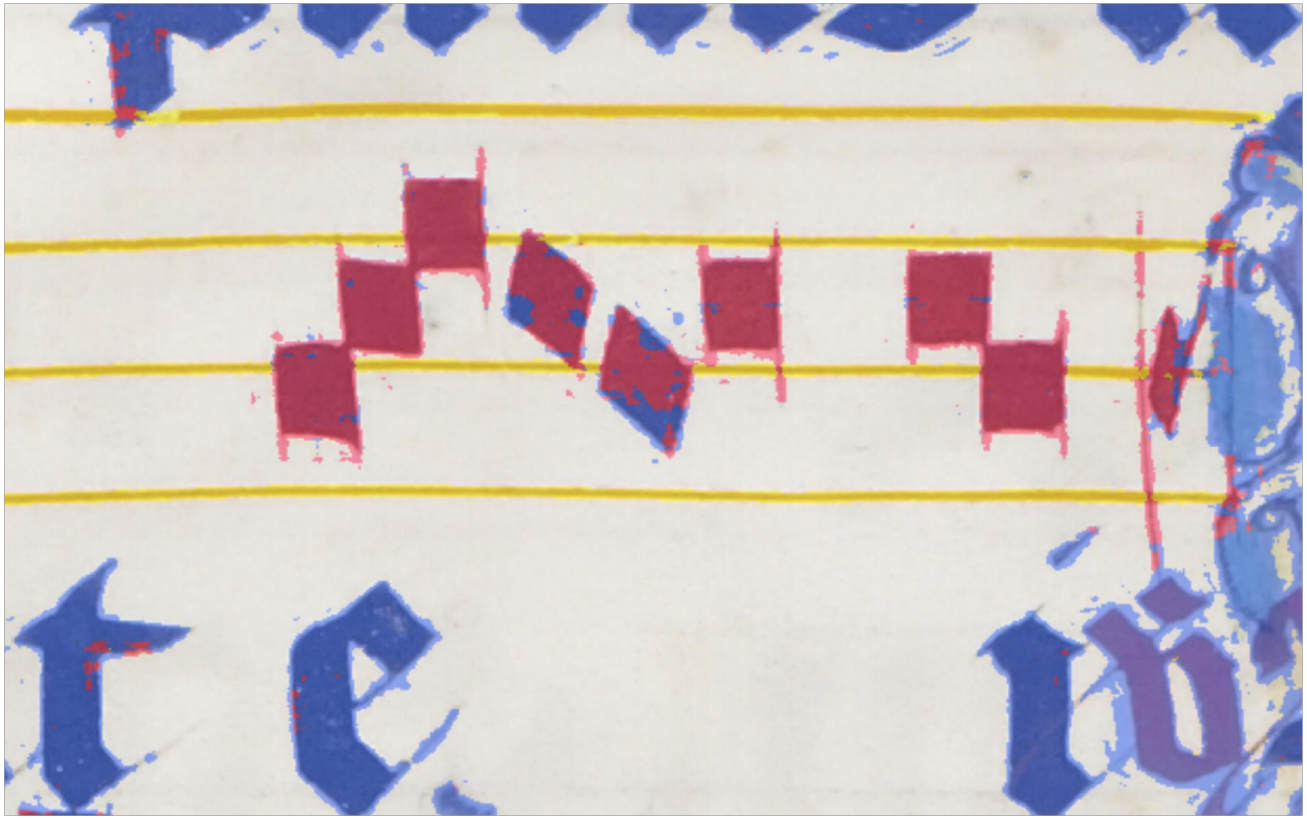


Salzinnes Antiphonal
CDN Hsmu M2149.L4

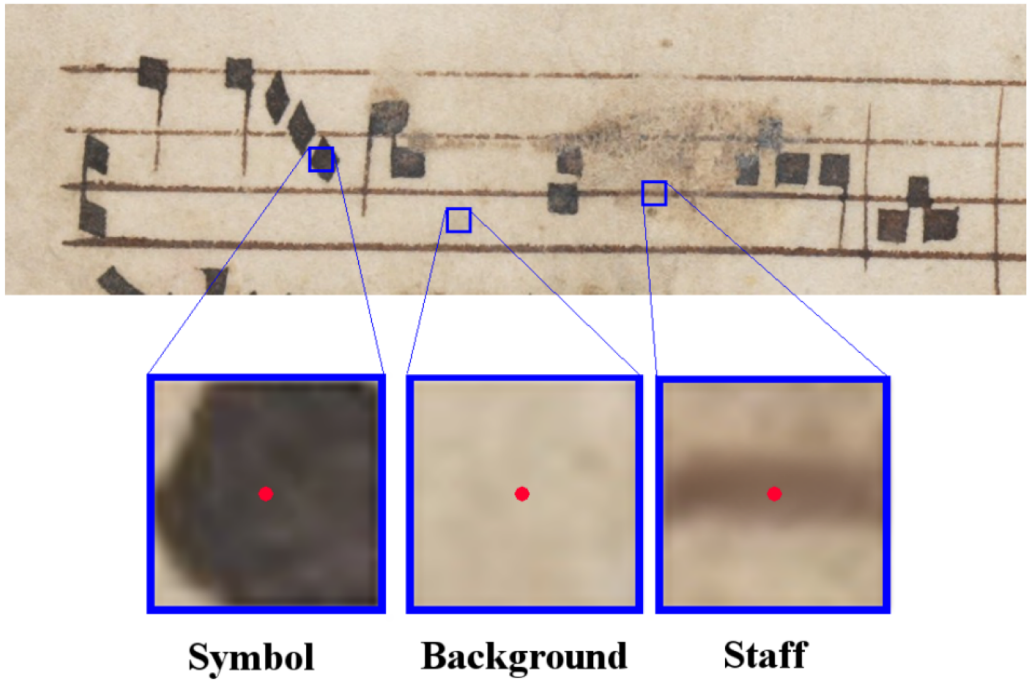
http://cantus.simssa.ca



Pixel.js: Making ground truth data

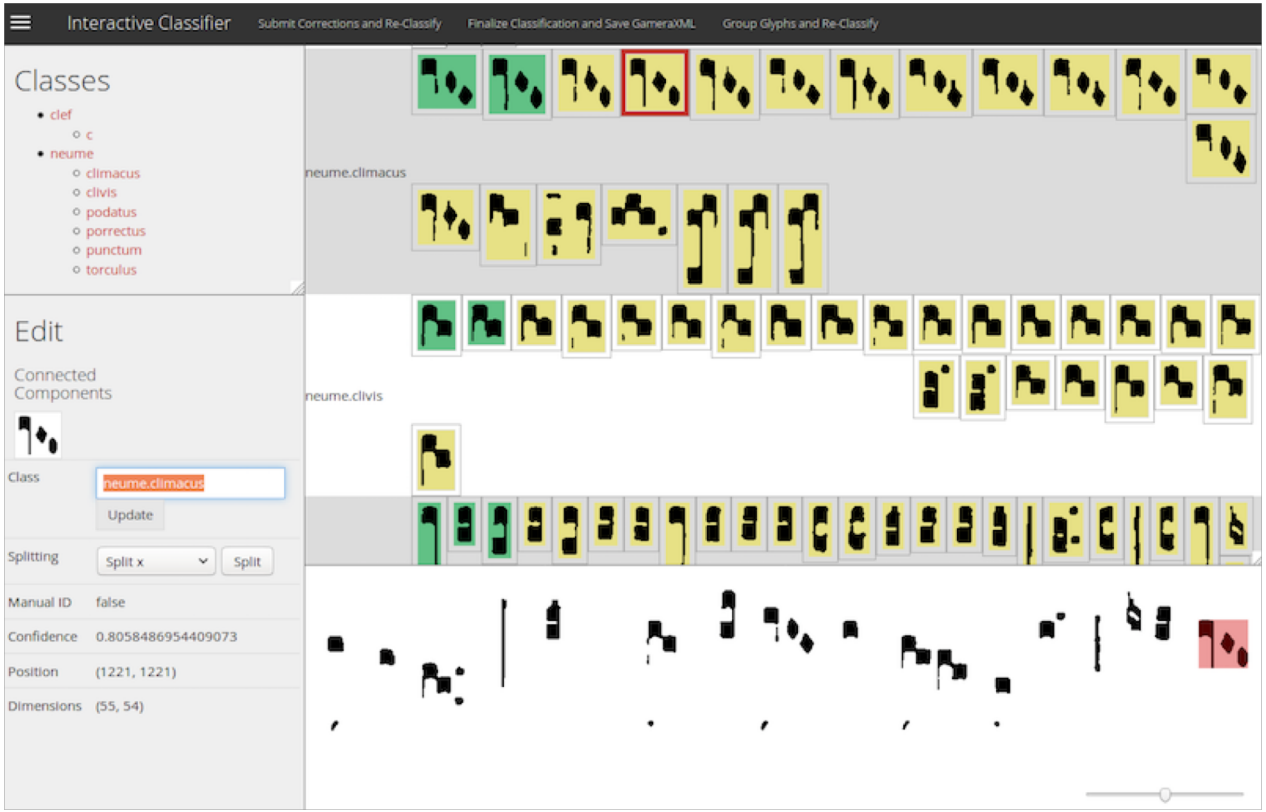


Pixelwise Classification

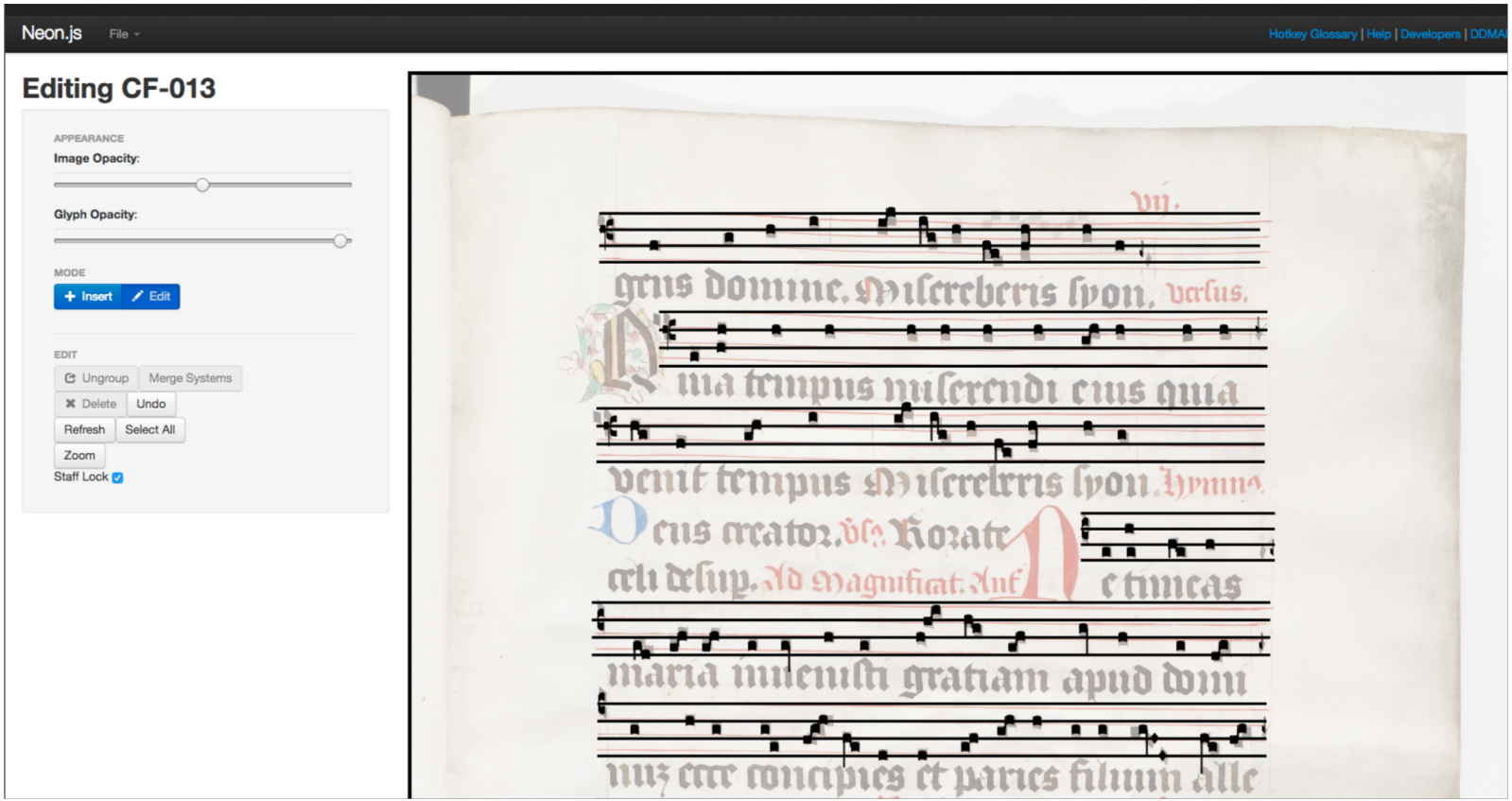


Calvo-Zaragoza, Jorge. “Pixelwise classification for music document analysis.” Presented at the Workshop on SIMSSA XII, August 7, 2017.

Interactive Classifier: Identifying glyphs & training our OMR



Neon.js: Correcting OMR output

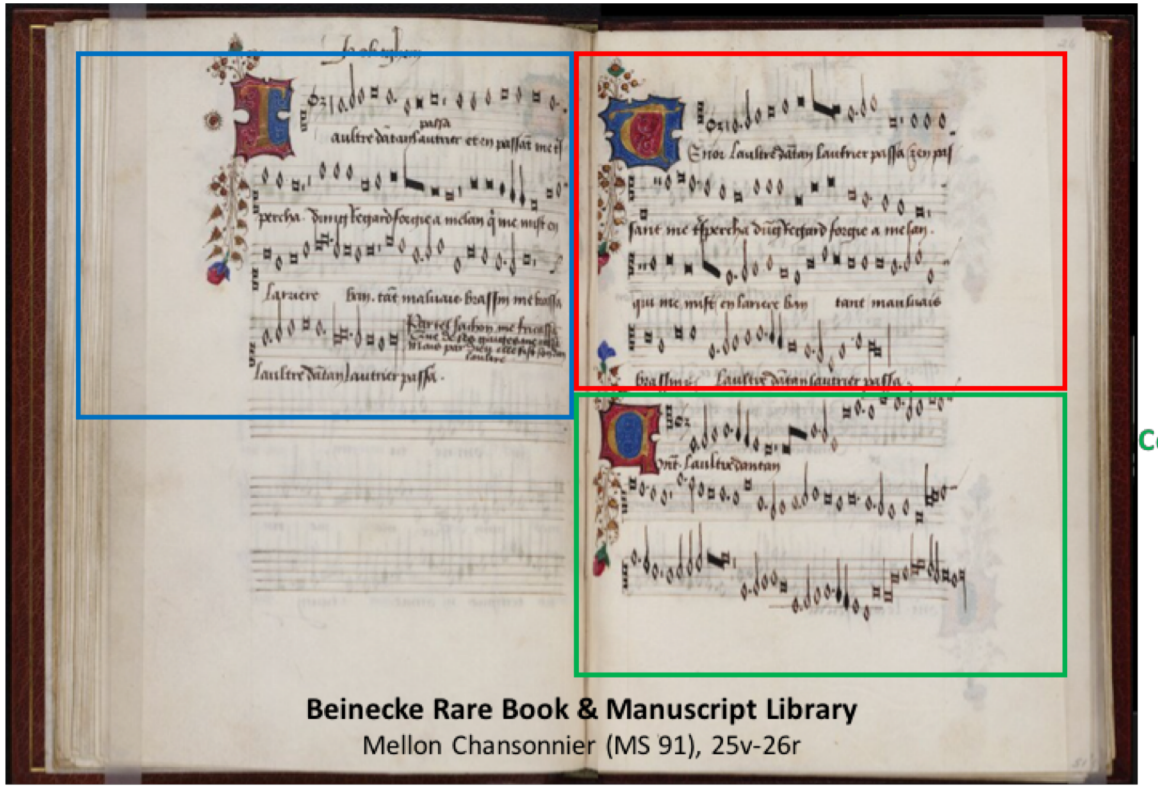


Scoring-up Tool

Superius

Tenor

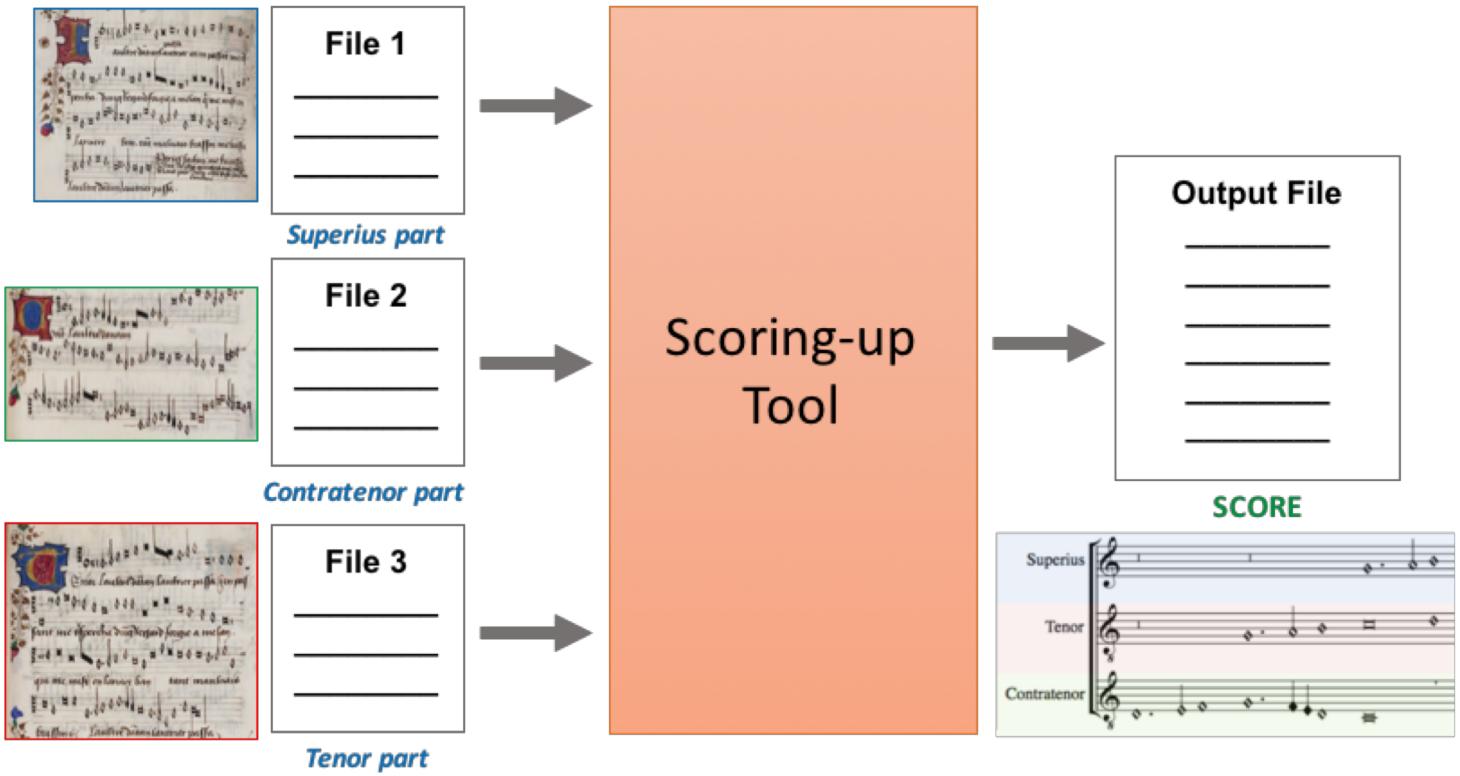
Contratenor



2

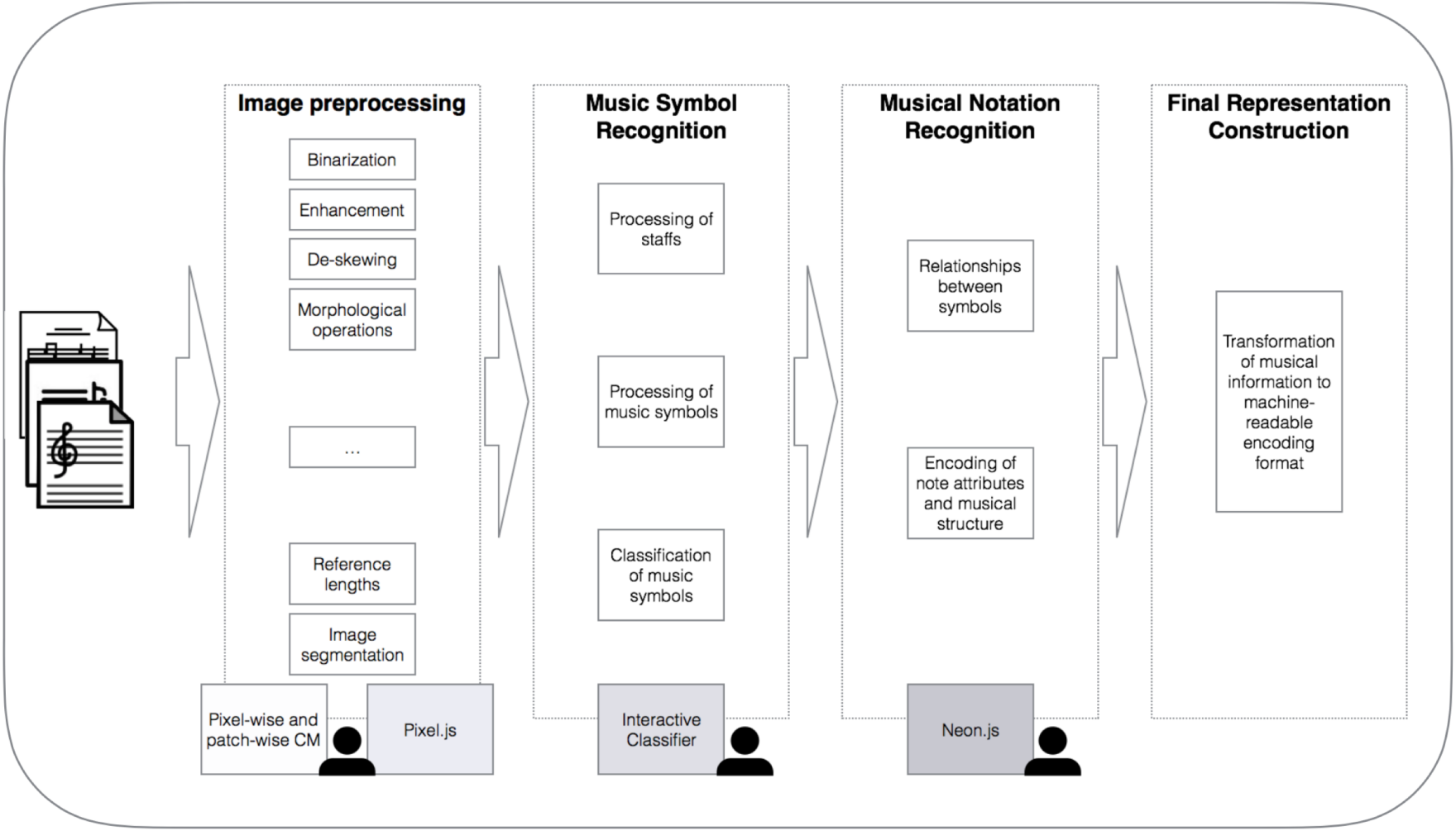
Slide courtesy of Thomae Elias, Martha Eladia, Julie Cumming, and Ichiro Fujinaga. "Automatic Scoring up of Music in Mensural Notation." Presented at the 46th Medieval and Renaissance Music Conference, Maynooth, Ireland, July 2018.

Scoring-up Tool



4

Slide courtesy of Thomae Elias, Martha Eladia, Julie Cumming, and Ichiro Fujinaga. "Automatic Scoring up of Music in Mensural Notation." Presented at the 46th Medieval and Renaissance Music Conference, Maynooth, Ireland, July 2018.



RODAN: Web-based distributed OMR workflow system (Hankinson 2014)

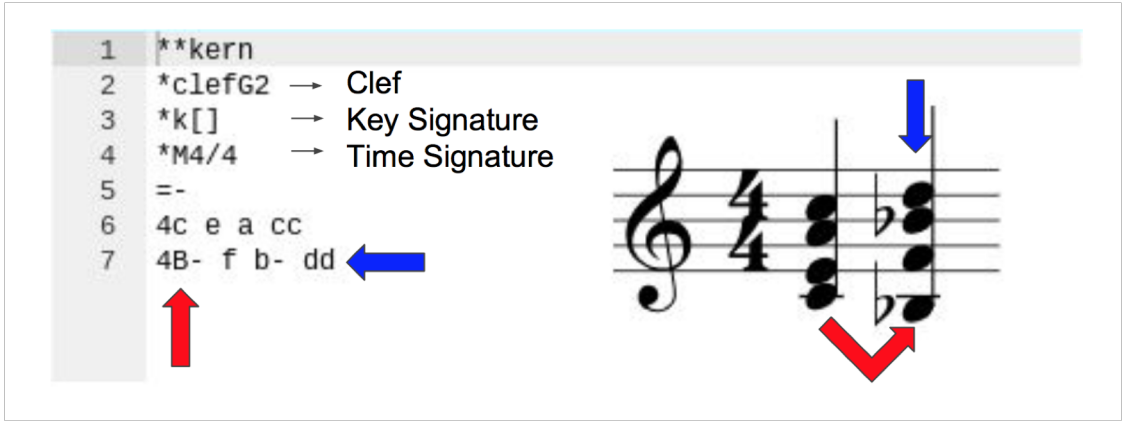
Crowdsourced OMR Correction

- Making tools more user-friendly
- Collaboration with Partner organizations and user communities

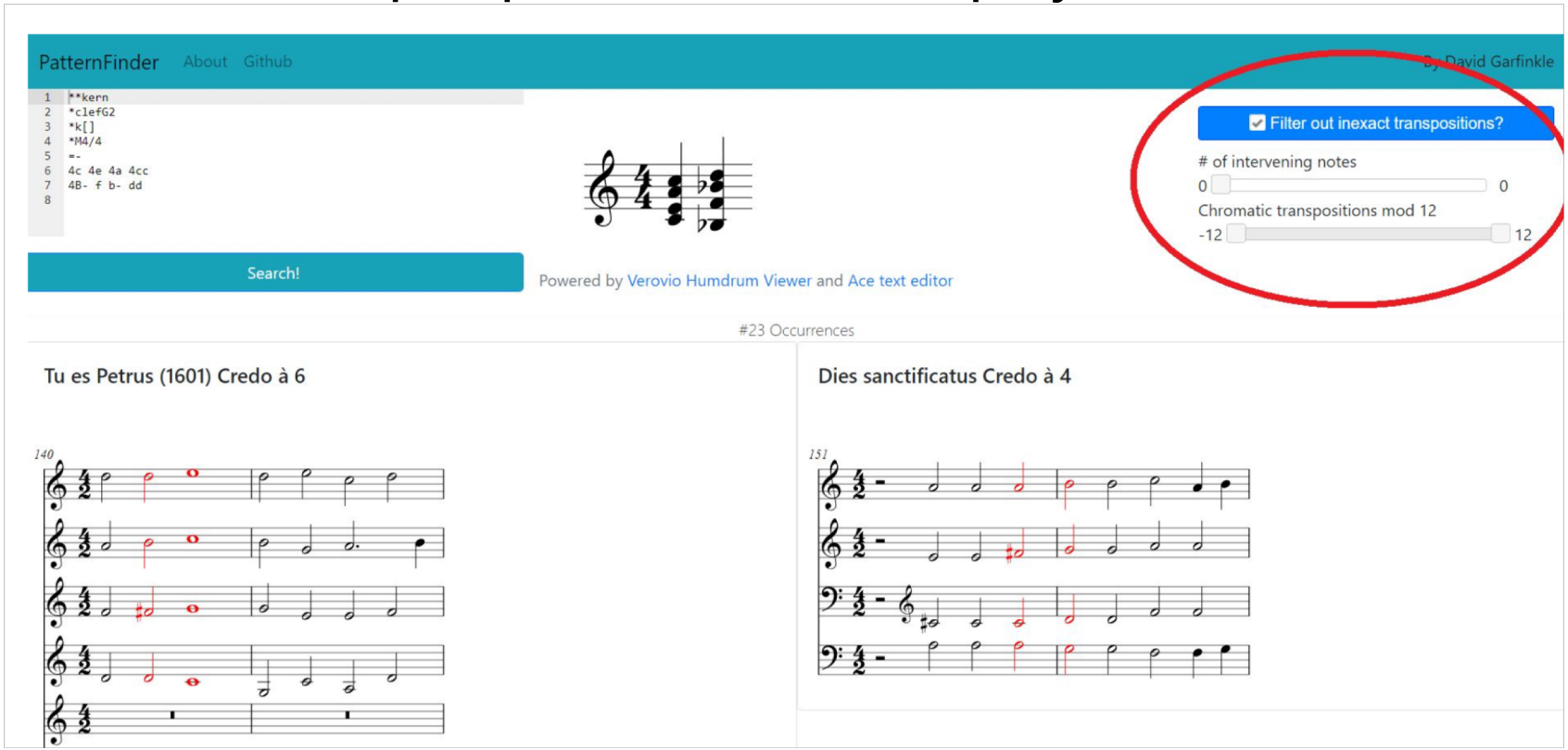
How will music search and analysis work?

Melodic Search

Garfinkle, David & Peter Schubert. “Computer-Assisted Corpus Analysis Finds a Signature Progression in Willaert and Palestrina.” Presented at the 46th Medieval and Renaissance Music Conference, Maynooth, Ireland, July 2018.

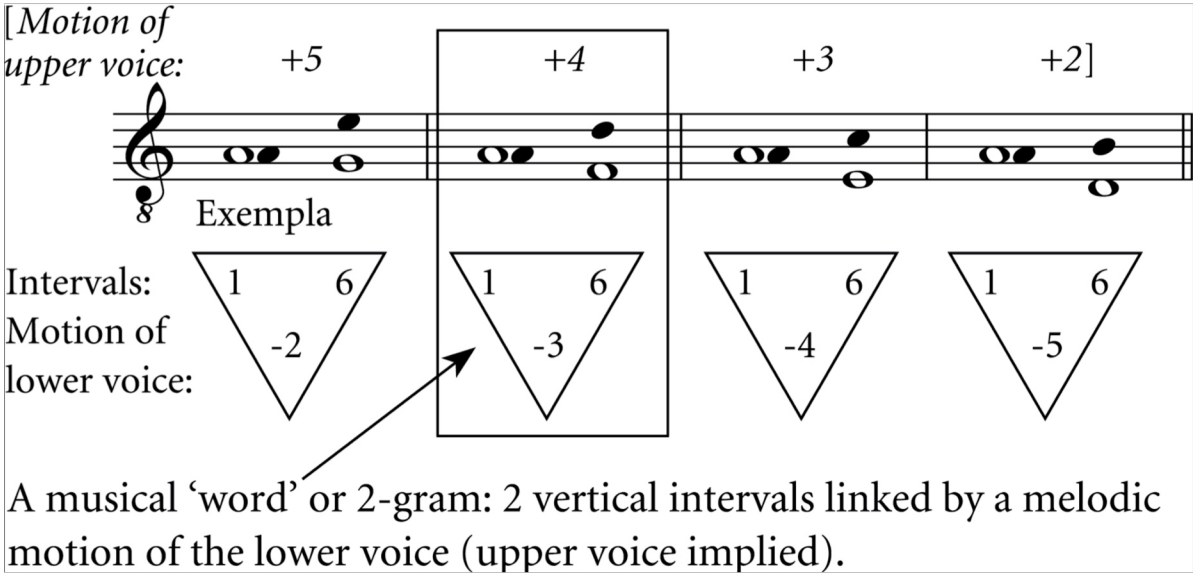


https://patternfinder.elvisproject.ca/

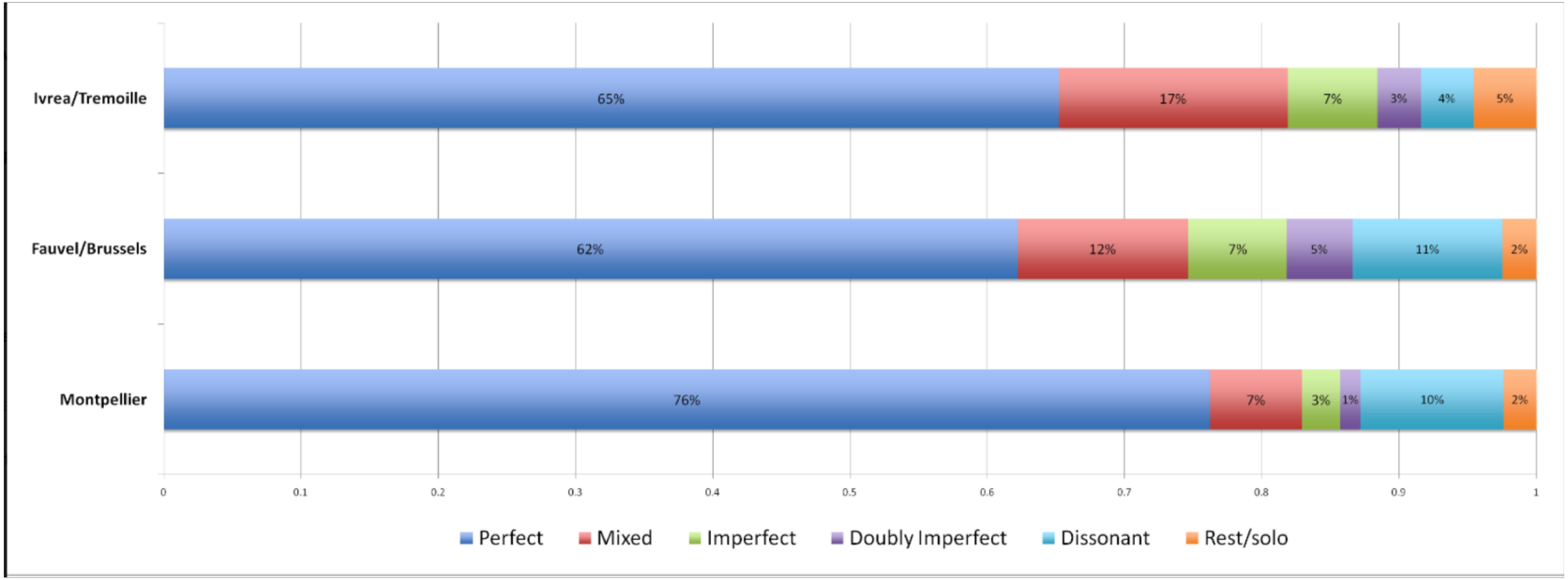


Corpus Studies

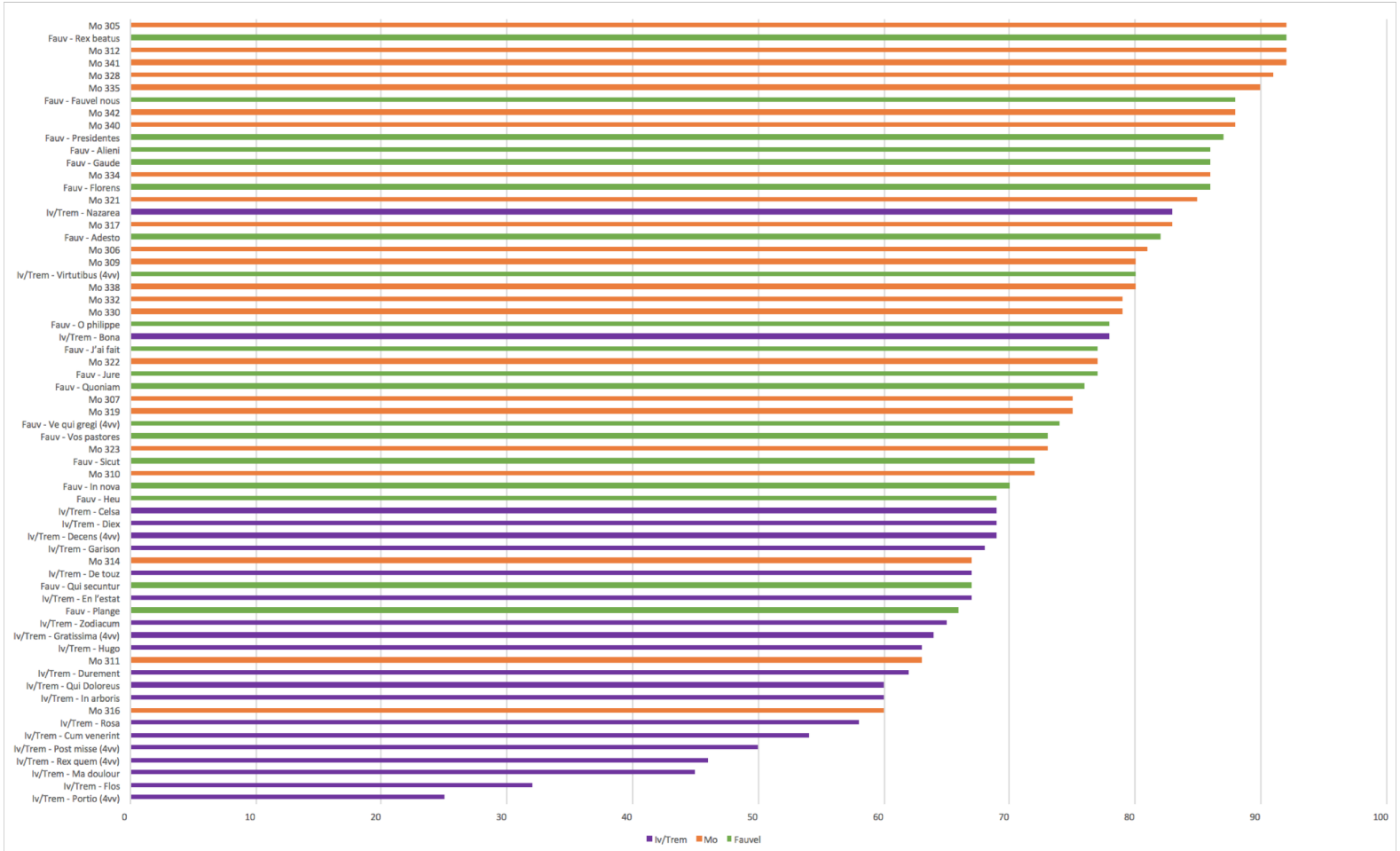
Schubert, Peter, and Julie Cumming. “Another Lesson from Lassus: Using Computers to Analyse Counterpoint.” Early Music 43, no. 4 (November 2015): 577–86.



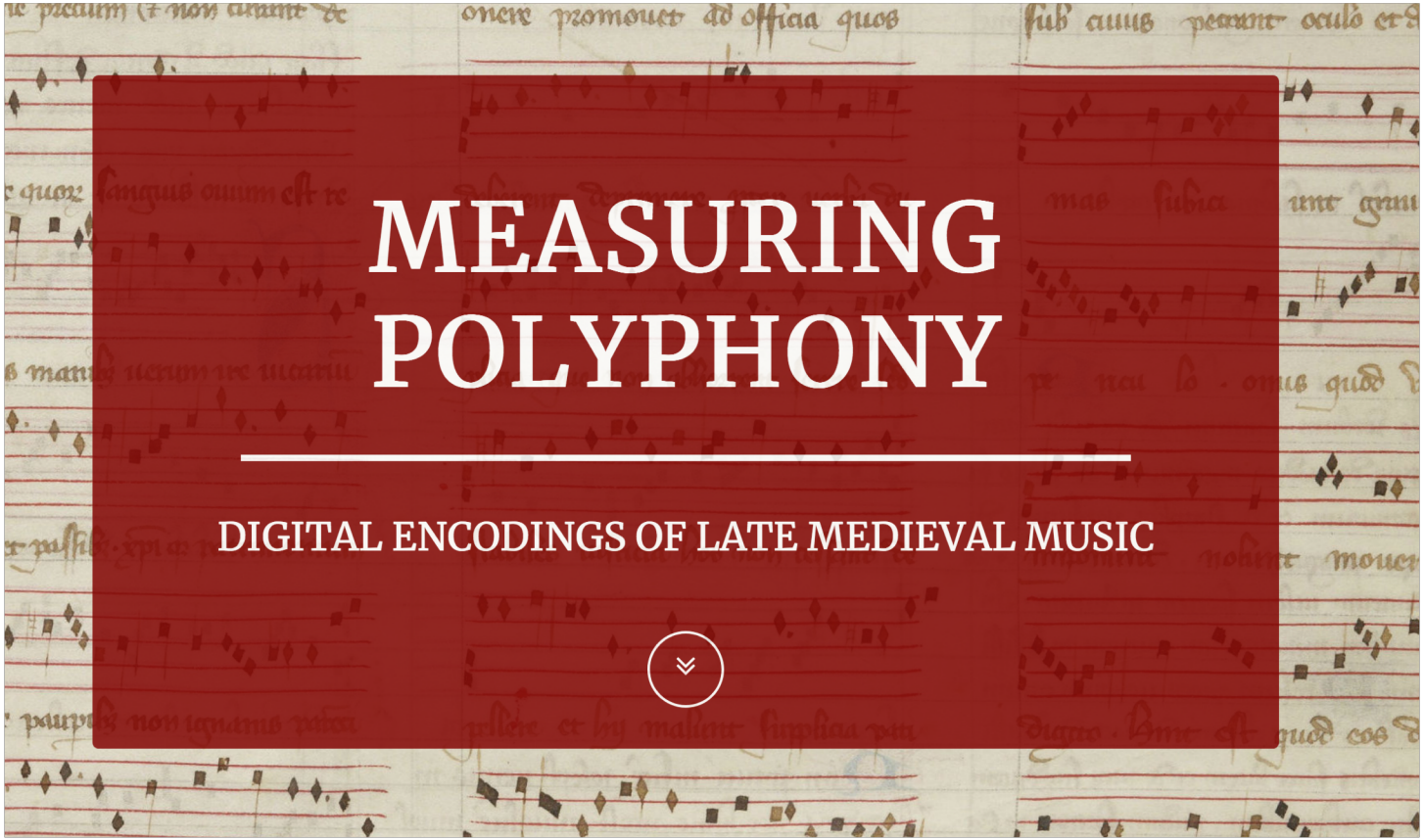
Desmond, Karen, Emily Hopkins, and Sam Howes. “Measuring Polyphony: Analysing Stylistic Change in the French Motet Repertory, C1300-1350.” Presented at the Workshop on SIMSSA VIII, McGill University, Montreal, QC, May 21, 2016.



Percentage of perfect sonorities for all pieces



http://measuringpolyphony.org/



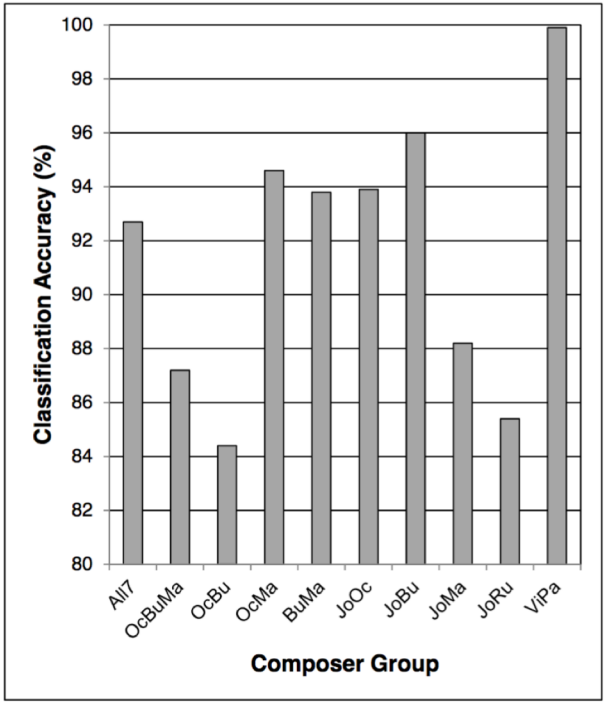
Arthur, Claire, Julie Cumming, and Peter Schubert. “Computer-Assisted Modal Identification.” Presented at the 46th Medieval and Renaissance Music Conference, Maynooth, Ireland, July 2018.

Melodic Data, with comparison sets		
Regression model	**Mode**	**Mode family**
test data: leaps and outlines	36%	67%
comparison set 1: remainder notes	39%	68%
comparison set 2: pc distributions	45%	71%
Experiment w/ experts		
experiment 1: pc tallies	35%	65%
experiment 2: pitch, interval size & direction	39%	61%
Full score experiment	67.5%	100%

Machine learning and composer identification

McKay, Cory, Tristano Tenaglia, Julie Cumming, and Ichiro Fujinaga. “Using Statistical Feature Extraction to Distinguish the Styles of Different Composers.” Presented at the Medieval and Renaissance Music Conference, Prague, Czech Republic, July 4, 2017.

Composer Group	Classification Accuracy
All 7	92.7%
Ockeghem / Busnoys / Martini	87.2%
Ockeghem / Busnoys	84.4%
Ockeghem / Martini	94.6%
Busnoys / Martini	93.8%
Josquin / Ockeghem	93.9%
Josquin / Busnoys	96.0%
Josquin / Martini	88.2%
Josquin / La Rue	85.4%
Victoria / Palestrina	99.9%



Thank you!

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