SIMSSA DB: An Introduction

Cory McKay

Marianopolis College, Canada

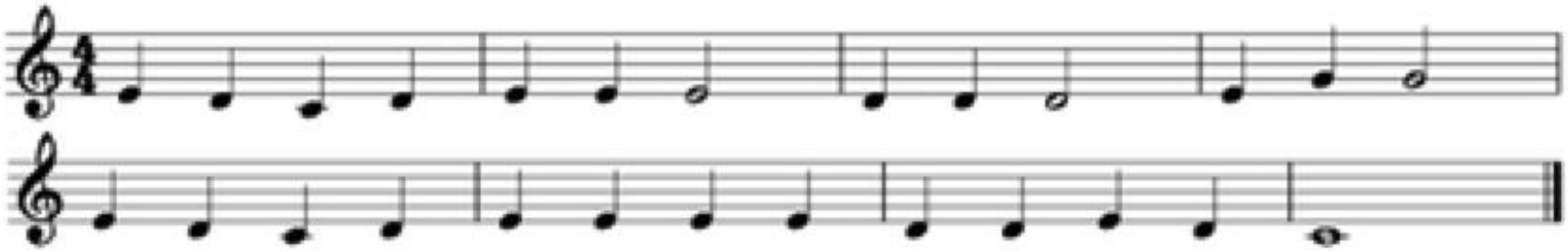
CIRMMT, Canada

An initial meander: What is a "feature?"

- Information that measures a characteristic of a segment of music in a simple, consistent and precisely-defined way
- Represented using numbers
  - Can be a single value, or can be a set of related values (e.g., a vector of histogram bin values)
- Provides a summary description of the characteristic being measured
  - Usually provides a macro rather than local view
- Usually extracted from pieces or distinct sections (e.g., mass movements) in their entirety
  - But can also be extracted from smaller segments of music

Example: A simple feature

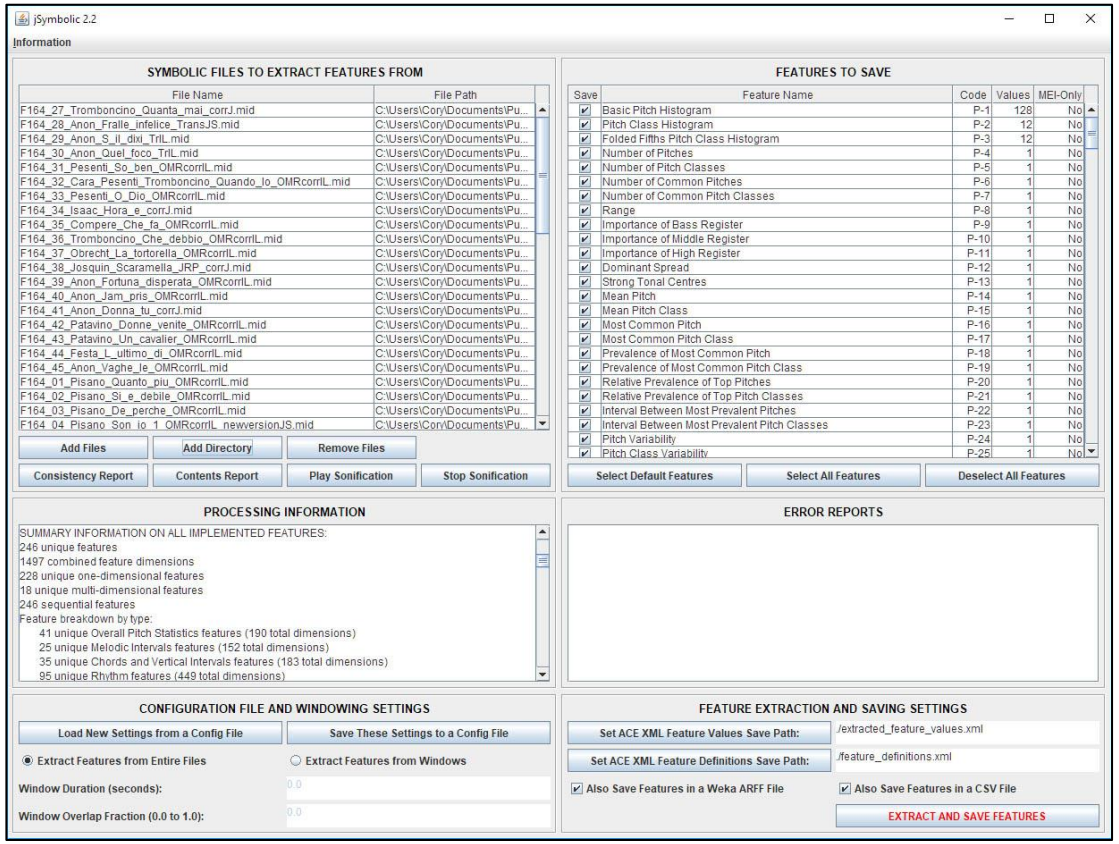
- Range: Difference in semitones between the lowest and highest pitches present
  - A 1-dimensional feature



- Value of this feature for this music: 7
  - G - C = 7 semitones

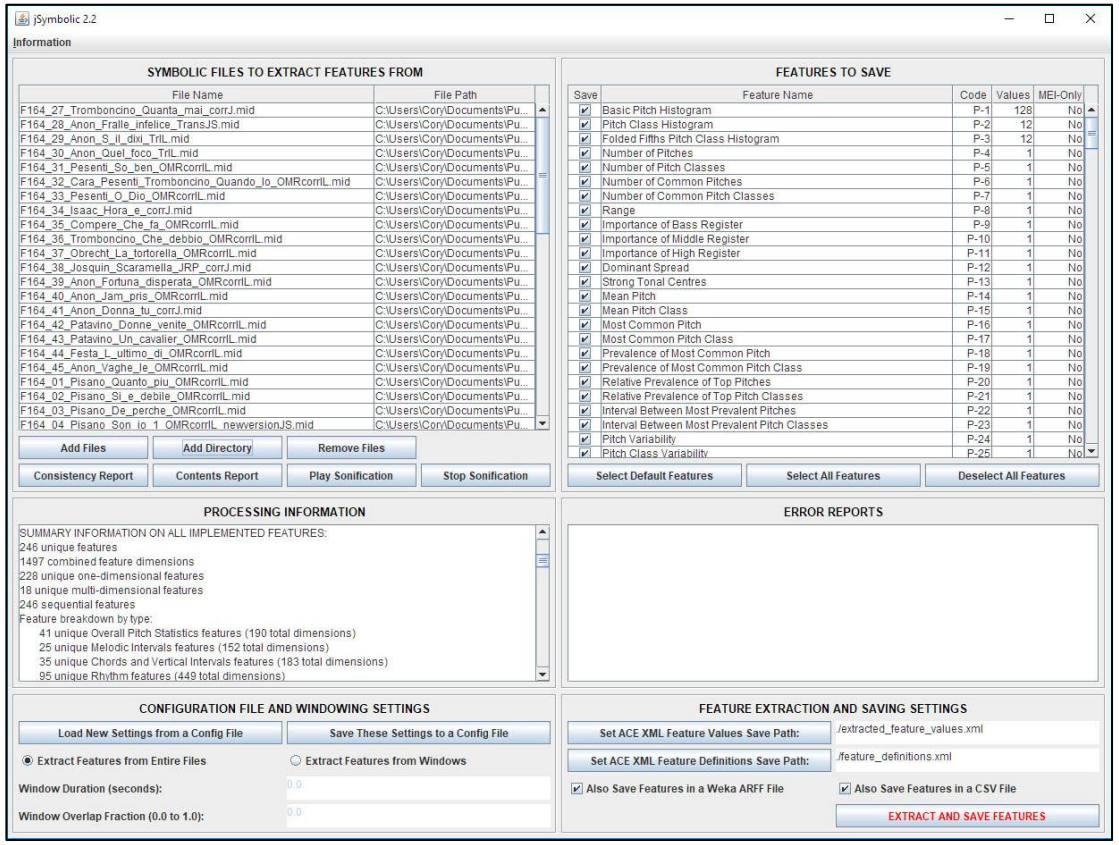
How can one calculate features?

- The jSymbolic research software (McKay et al. 2018) can be used to automatically extract features from symbolic digital scores
  - Open source
  - General purpose
- Version 2.2 extracts 246 unique features
  - 1497 separate feature values, since many features a multi-dimensional (e.g. histogram vectors)



jSymbolic's feature types

- Pitch statistics
  - e.g. Range
- Melody / horizontal intervals
  - e.g. Most Common Melodic Interval
- Chords / vertical intervals
  - e.g. Vertical Minor Third Prevalence
- Texture
  - e.g. Parallel Motion
- Rhythm
  - e.g. Note Density per Quarter Note
- Instrumentation
  - e.g. Note Prevalence of Unpitched Instruments
- Dynamics
  - e.g. Variation of Dynamics



Features, what are they good for?

- Provide an empirical basis for musicological comparison and classification
  - Using automated machine learning and statistical analysis
  - Manually by experts
- Can study very large large quantities of music
- Can explore a very broad range of musical characteristics and their interrelationships
  - Including aspects one may not have thought to consider
- No need to specify specific queries or heuristics before beginning analyses if one does not wish to
  - Facilitates exploratory research
- Help to bypass potentially incorrect ingrained assumptions and biases

Samples of previous early music research with jSymbolic features

- Composer attribution
  - McKay et al. 2017
- Coimbra manuscripts
  - Cuenca & McKay 2019; Cuenca & McKay 2021
- *Ave verum corpus* and *O decus virgineum*
  - Rodriguez-Garcia & McKay 2021
- *Ave festiva ferculis*
  - Rodriguez-Garcia & McKay 2021
- Morales and Guerrero
  - McKay & Cuenca 2021
- Origins of the madrigal
  - Cumming & McKay 2018; Cumming & McKay 2021
- Buch
  - Cuenca & McKay 2022

Cory's status circa 2017

- I could extract lots of great features
- I was collaborating with wonderfully insightful musicologists
- How could things possibly get even better?
  - Wanted to find new ways to use features
  - Wanted to collaborate more directly with wonderful co-grantees working on OMR
  - Wanted more high-quality symbolic scores
  - Wanted to be able to share extracted features
    - Both generally and related to specific studies
  - Wanted to search for scores based on content, not just metadata

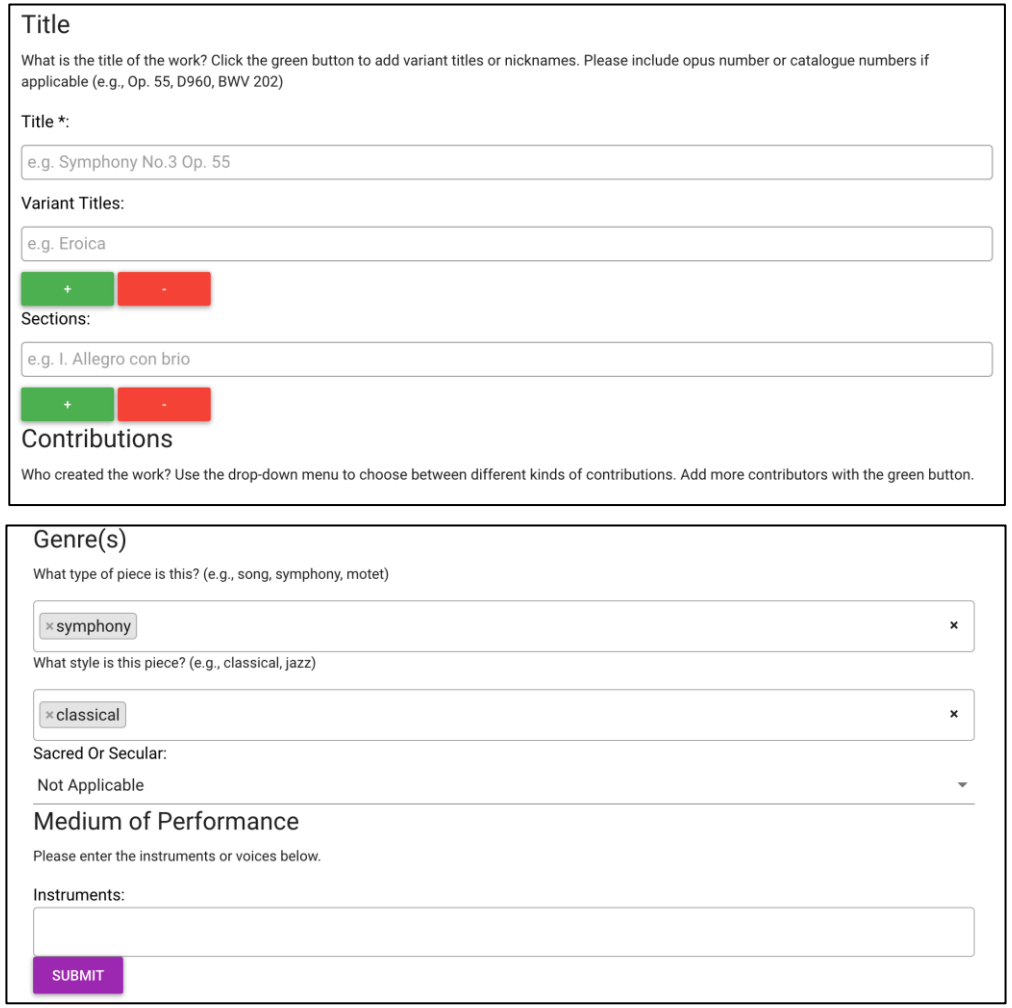
And so SIMSSA DB was born!

- Collaborative database prototype infrastructure for holding and accessing symbolic music files and associated features (and more)
  - Web browser interface
- Populated by:
  - **Now:** Samples from datasets we have constructed
  - **Medium-term:** Import existing open symbolic datasets that musicologists, libraries and others have already constructed
  - **Long-term:** Auto-population via (verified) OMR
- Focused (for now) on early music

An infrastructure, not a corpus

- The SIMSSA DB is not intended just as a repository of music we have transcribed ourselves
  - Although it is seeded with datasets we have made, such as JLSDD (Cumming et al. 2018), Florence 164 (Cumming & McKay 2018), etc.
- Rather, it is a general unified infrastructure to which other scholars can contribute and share symbolic music files (and more) that they have used in their own work

SIMSSA DB prototype contribution form



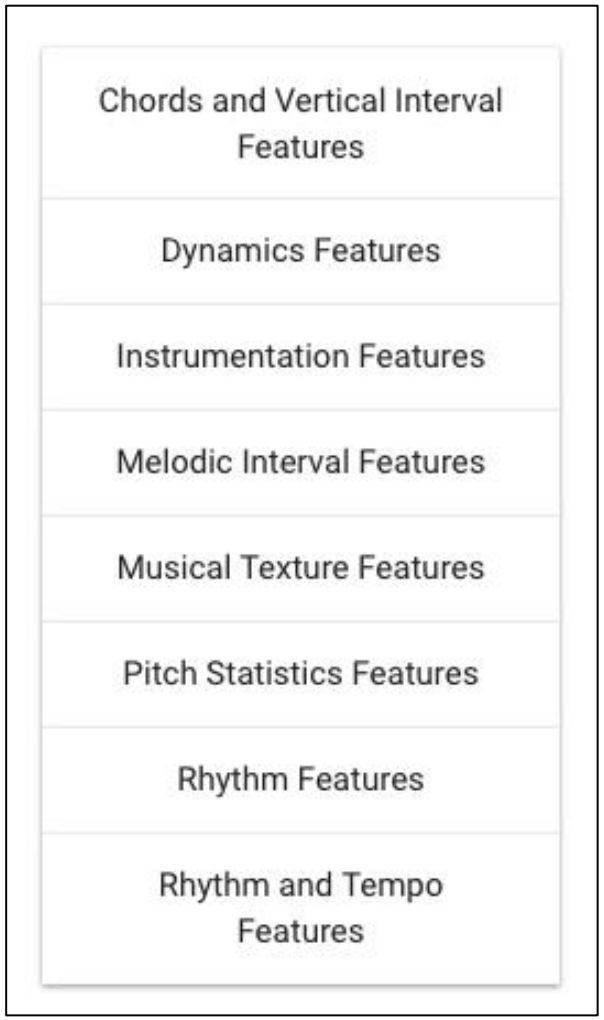
Metadata searches

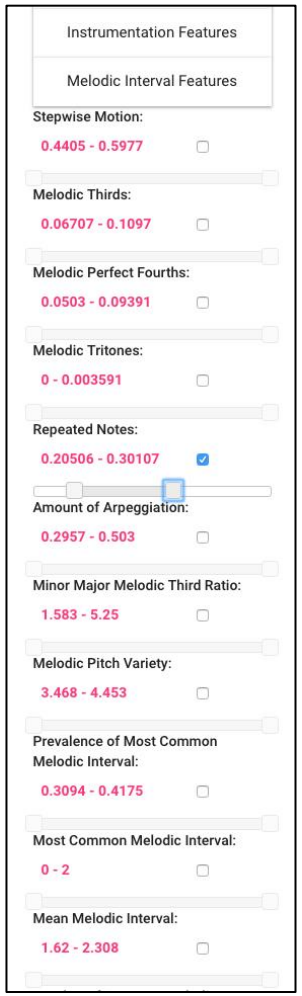
- SIMSSA DB may be searched using traditional metadata queries:
  - Free-text search
  - Faceted metadata filters, such as:
    - Contributor
      - Composer, arranger, author of text, transcriber, etc.
    - Sacred, secular, etc.
    - Instruments / voices
    - Genre / type of work
      - e.g. madrigal, motet, etc.
    - Etc.

SIMSSA DB and features (1/3)

- SIMSSA DB may also be searched based on musical content via features
  - jSymbolic 2.2 features, specifically
- jSymbolic has been integrated into the SIMSSA DB
  - Whenever a file is uploaded to the SIMSSA DB, features are automatically pre-extracted and stored
- Users can search the database based on musical content using these features

SIMSSA DB and features (2/3)





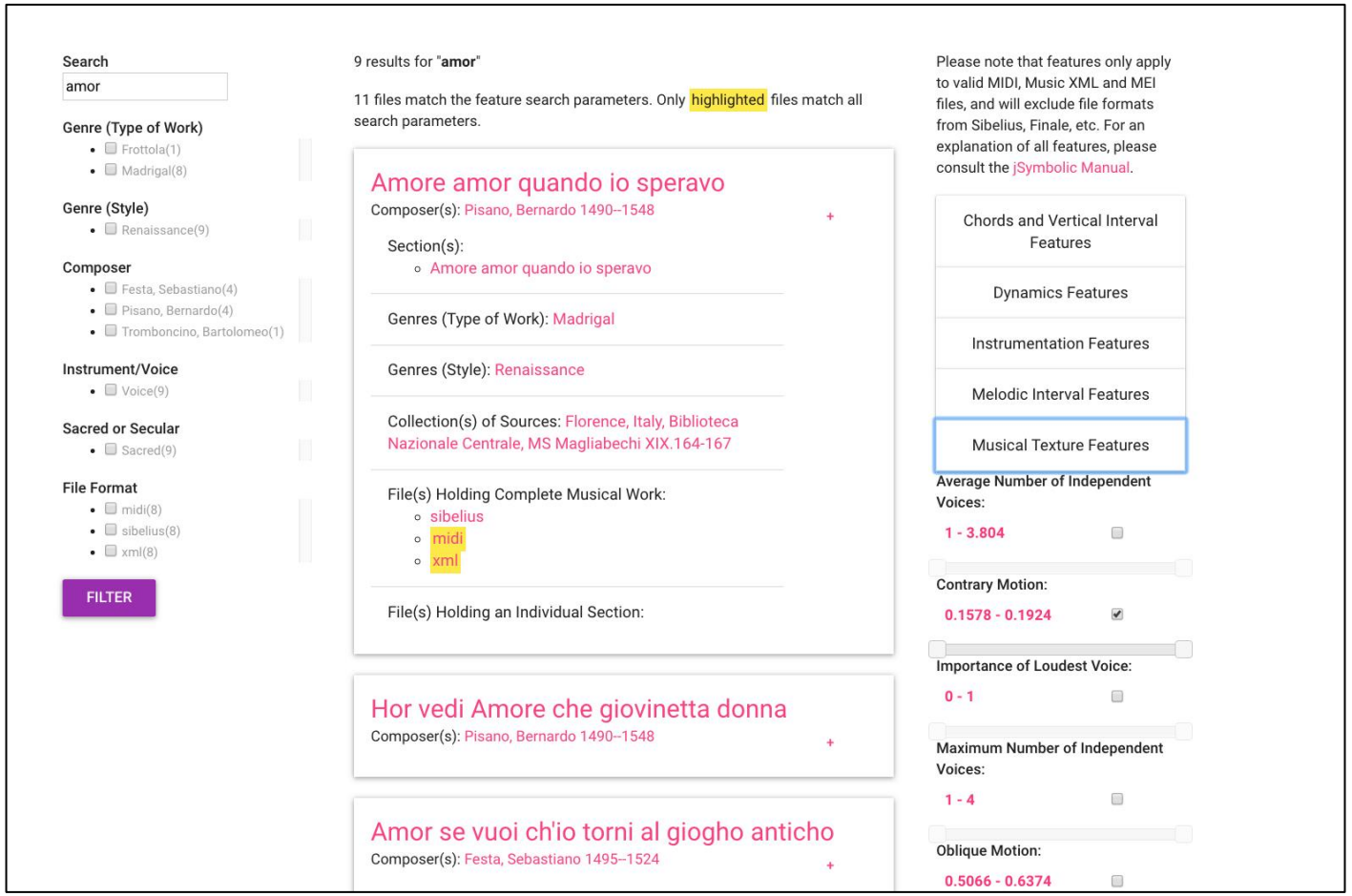
- Users can specify feature-range queries via a slider for each feature they are interested in

SIMSSA DB and features (3/3)

- Can also download complete feature sets directly and use them as input to statistical analysis and machine learning tools (or analyze them manually)
  - As in the jSybmolic studies referred to earlier

- Feature searches can also be combined with metadata searches
  - e.g. retrieve all sacred pieces attributed to Josquin that contain parallel fifths

Sample query



Highlights of the SIMSSA DB

- Designed to meet the specific needs of scholars wishing to engage in large-scale computational musicological research
  - Emphasis on usability
- Feature-based search combined with free-text and faceted metadata search
  - Full sets of auto-extracted feature values can also be downloaded
- Emphasis on research-relevant data structuring (more on this tomorrow)
  - Modeling of complex abstract musical relationships
    - e.g., relationships between sources and (abstract) works, sections and parts
    - e.g., linking different kinds of musical documents
  - Provenance chains
  - Authority control and cataloguing standards
  - Archiving of specific corpora and associated features from specific studies

Credit to the deserving

- I designed the original data model and provided high-level guidance to the project
  - Along with Julie Cumming
- Emily Hopkins supervised most of the actual development work
- Gustavo Polins Pedro and Yaolong Ju did all of the actual implementation work
- We also received important insight and suggestions from a variety of generous contributors
  - Especially Ichiro Fujinaga

Current status

- We are coming out of a two-year development hiatus that followed the loss of our entire development team during the pandemic lockdowns
  - Prior to the pandemic they had completed a prototype interface and were beginning user testing and consultation with domain experts
- The hope is to recruit a new development team in the near future and take up where we left off
- Tim de Reuse recently kindly resurrected a limited partial version of the DB test instance running on Compute Canada for demo and test purposes
  - https://db.simssa.ca
  - Will briefly demo it at tomorrow's session

Thanks for your attention!

cory.mckay@mail.mcgill.ca

Social Sciences and Humanities Research Council of Canada

Conseil de recherches en sciences humaines du Canada

Canada

Fonds de recherche sur la société et la culture Québec

MARIANOPOLIS COLLEGE

jMIR

CIRMMT Centre for Interdisciplinary Research in Music Media and Technology

McGill

Schulich School of Music
École de musique Schulich