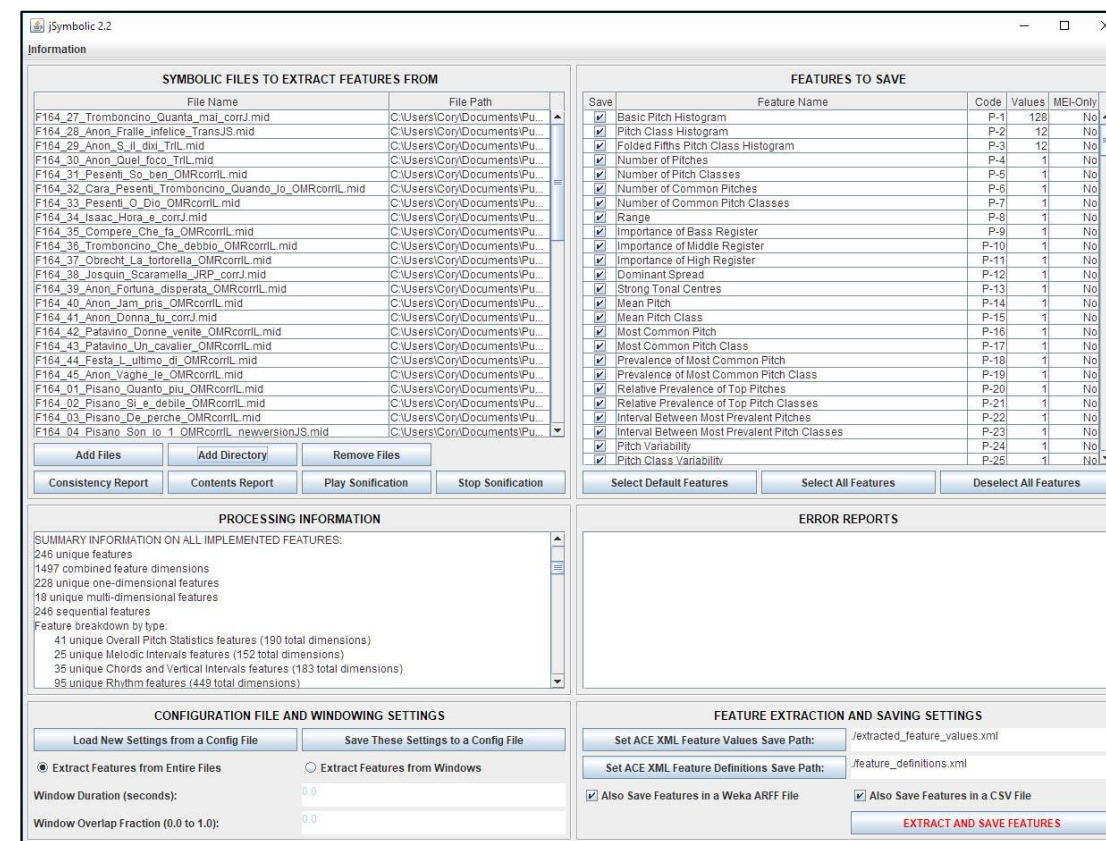# Ongoing work in music information retrieval and musicology

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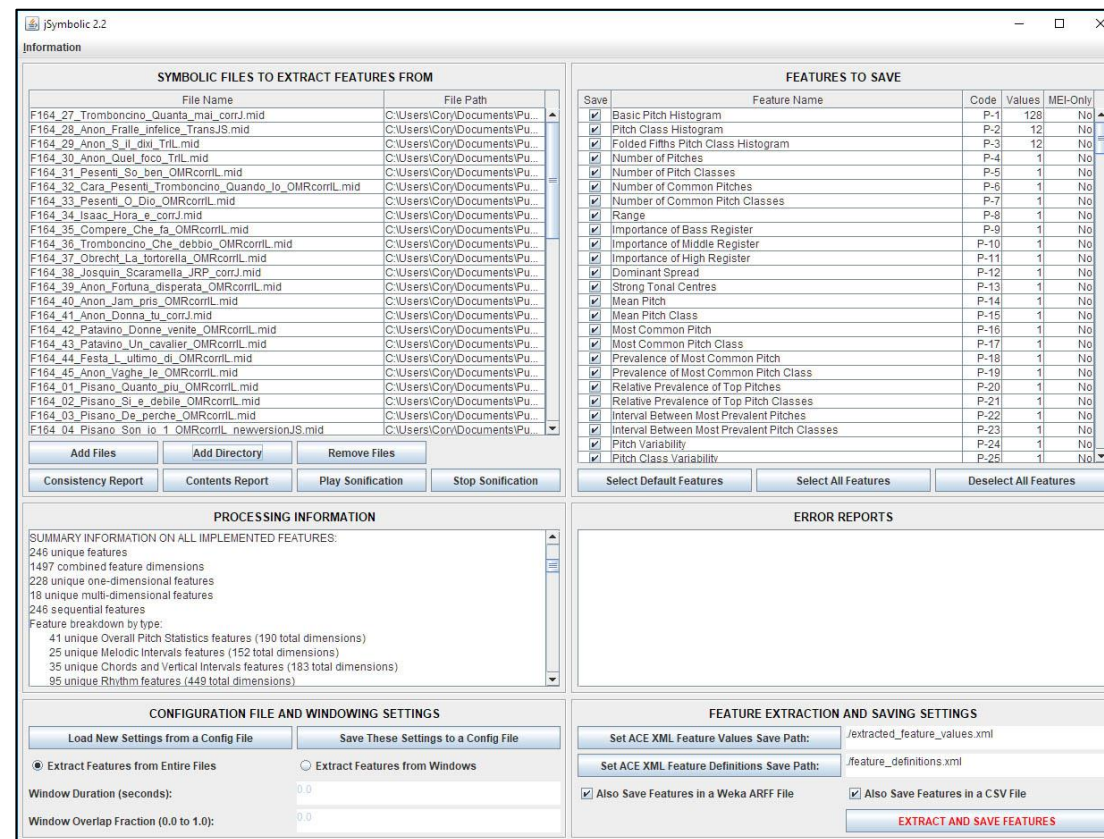
Extracting features with jSymbolic

- The jSymbolic research open-source software (2004 to present) automatically extracts features from symbolic digital scores (MIDI and MEI)

- Features used for:
  - Direct musicological exploration
    - Statistical analysis
    - Manual examination
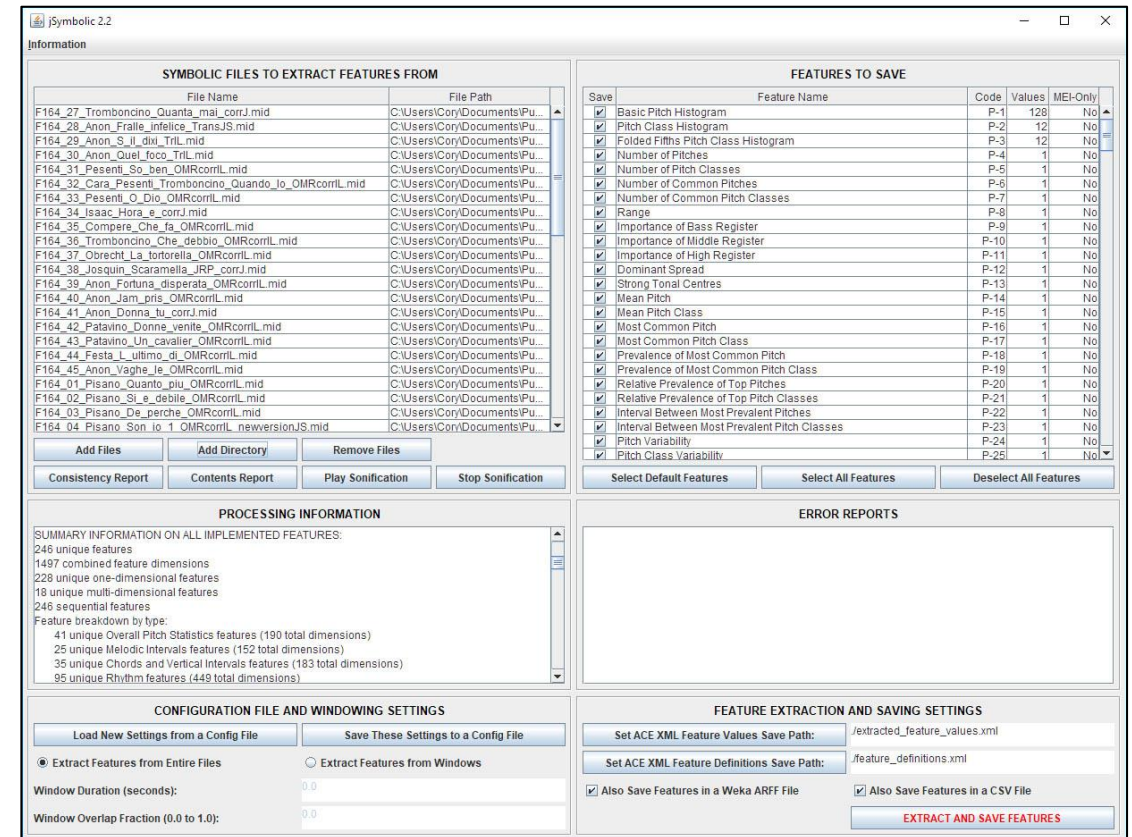 - Training models using machine learning

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

Extracting features with jSymbolic

- The newest version (jSymbolic3) is currently undergoing final code review and testing

- Extracts 533 unique features and 2040 feature values
  - Up from the current (2.2) release version's 246 and 1497, respectively

- Includes new features based on n-grams
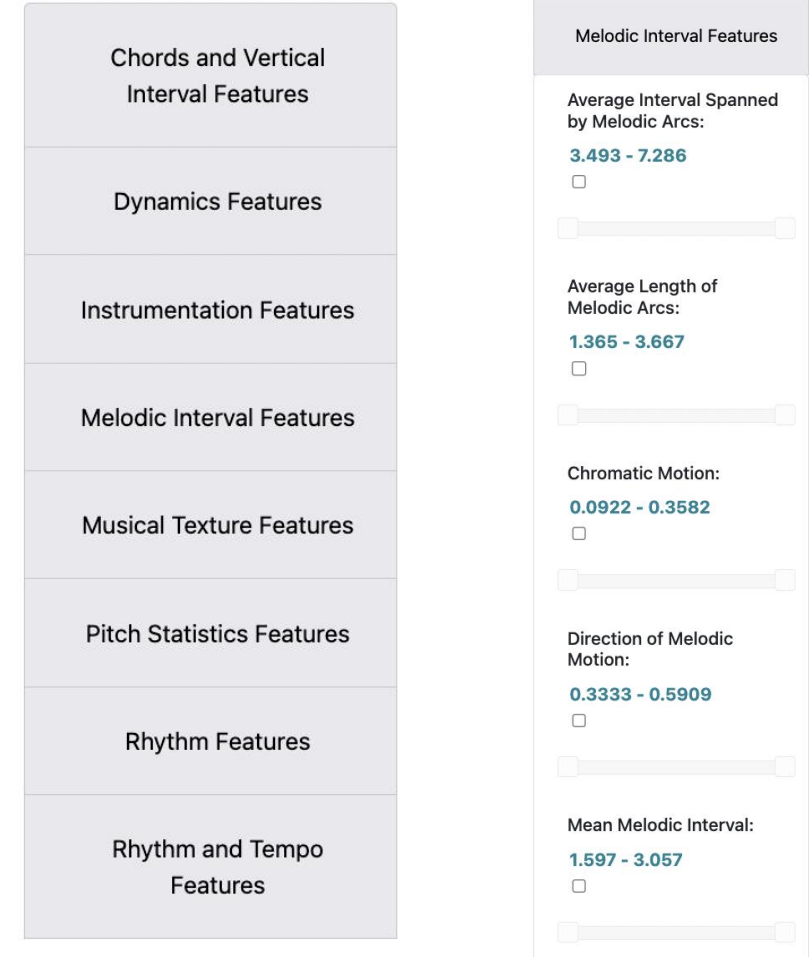 - Horizontal / melodic
  - Vertical / harmonic
  - Rhythmic

Current musicological research projects based on features

- Origins of the madrigal (with Julie Cumming)
  - *Prior work:* Cumming & McKay 2018; Cumming & McKay 2021
  - Soon to be revisited with an expanded corpus

- Josquin attribution certainty (with Julie Cumming)
  - *Pilot study:* McKay, Cumming & Fujinaga 2017
  - Currently working on new a book chapter comparing separately published judgements based purely on historical evidence (not content) with our purely content-based feature analysis
  - More details in a separate presentation today

- General ideas, challenges, processes and priorities for meaningful collaborations between musicologists and computational researchers (with María Elena Cuenca)
  - Upcoming conference presentation

SIMSSA DB

- A prototype database of symbolic music files intended for research in computational musicology
  - And, eventually, associated images, audio recordings, texts, etc.
- Searchable by:
  - Free text
  - Faceted metadata
  - Feature values
    - Auto-annotated by jSymbolic
- Recent work has focused on infrastructure for community contributions of symbolic music and associated metadata

Chords and Vertical Interval Features

Dynamics Features

Instrumentation Features

Melodic Interval Features

Musical Texture Features

Pitch Statistics Features

Rhythm Features

Rhythm and Tempo Features

Chords and Vertical Interval Features

Dynamics Features

Instrumentation Features

Melodic Interval Features

Average Interval Spanned by Melodic Arcs:
3.493 - 7.286

Average Length of Melodic Arcs:
1.365 - 3.667

Chromatic Motion:
0.0922 - 0.3582

Direction of Melodic Motion:
0.3333 - 0.5909

Mean Melodic Interval:
1.597 - 3.057

SIMSSA DB

- Additional priorities:
  - Chains of provenance
  - Authority control (using VIAF)
  - Modeling relationships between data, sources and (abstract) works, sections and parts
  - Corpora can be associated with specific studies (e.g., for repeatability of research)
- The SIMSSA DB is currently being linked to other music repositories so as to be searchable via a unified interface
  - Part of the long-term LinkedMusic project (2022-2029)
  - Involves other CIRMMT members, including Ichiro Fujinaga, Julie Cumming and Audrey Laplante, as well as numerous international partners

Multi-modal music classification

- I've also been working on multi-modal MIR research since 2004
  - i.e. combining information drawn from different types of musical data
    - e.g., audio recordings, lyrics, scores, playlist data, videos, images, music reviews, etc.
  - jSymbolic was originally just part of this project
- My multimodal work has recently focused on using genetic algorithms to explore different combinations of modalities and feature types
  - Features extracted from audio, lyric texts, symbolic scores, album cover images, semantic tags and playlist co-occurrences
  - Evaluated based on "importance," "redundancy" and "stability"
  - e.g., Vatolkin & McKay 2022a; Vatolkin & McKay 2022b
- Currently part of an application for DFG funding in Germany
  - Introducing more modalities
  - Building expanded multimodal datasets

Thanks for your attention

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