

jSymbolic in 2019: Updates and Improvements

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Introduction to jSymbolic

- jSymbolic is software that extracts **features** from **symbolic music files** (MIDI or MEI)
- A feature is a piece of statistical information that characterizes some aspect of a piece of music using a **simple, consistent measurement**
 - Each feature is expressed as one or more simple **numerical** values
 - Features can reveal meaningful patterns in music at a **macro** scale

Uses of features

- Training classification models with machine learning
- Statistical feature analysis
- Content-based searches
 - e.g. SIMSSA DB

jSymbolic's features (1/2)

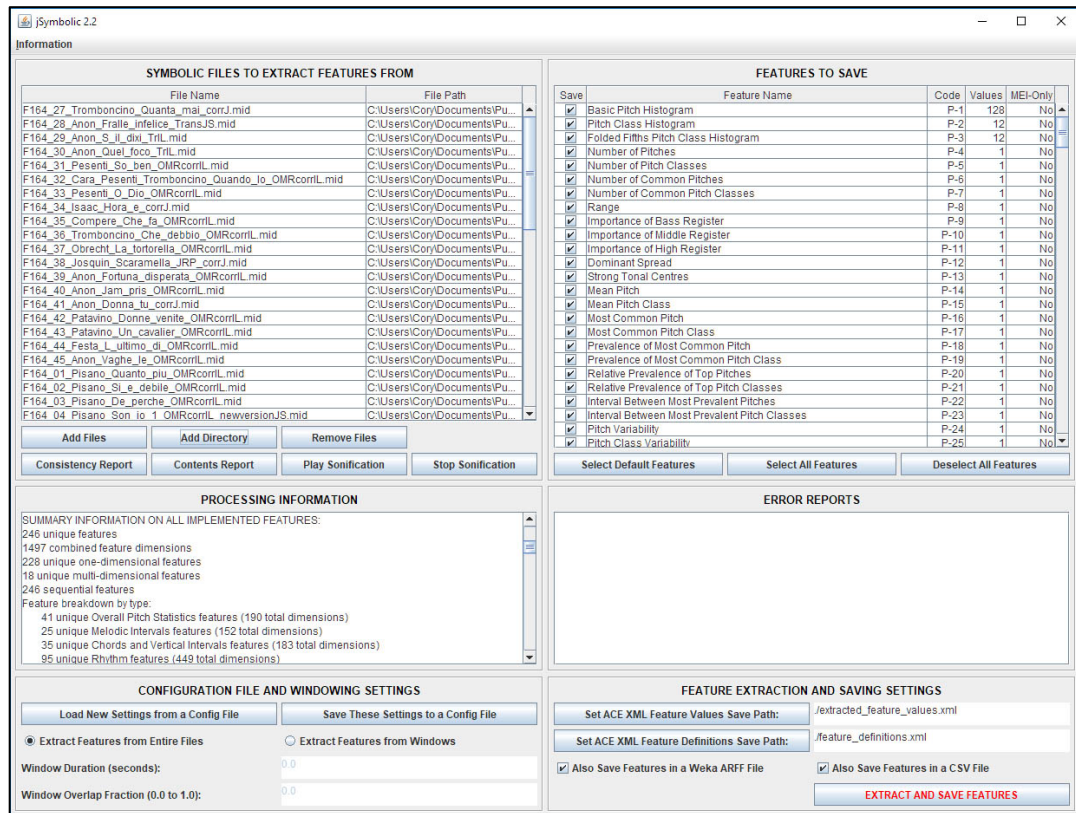
- The current 2018 release version (2.2) extracts **246 unique features**
 - **1497 distinct values** when multi-dimensional features (e.g. histograms) are expanded

jSymbolic's features (2/2)

- Feature types include:
 - 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

User interfaces

- Graphical user interface
- Command-line interface
- Java API
- Rodan workflow for distributed processing



New interface developments in 2019

- Expanded the already extensive tutorial and manual
- Expanded multilingual support
- Feature summary stat reports
- Many miscellaneous interface improvements

Extensibility

- jSymbolic is designed to encourage researchers to add their own bespoke features
 - Modular plug-in feature design
 - Easy to iteratively build new features of increasing sophistication by incorporating values of already-implemented features in new features
- jSymbolic's feature catalogue has already expanded greatly
 - The original 2006 jSymbolic 1.0 had 160 features, compared to the 2018 jSymbolic 2.2's 246 features
 - **Tristano Tenaglia** implemented a good share of these new features from 2015 to 2016

New features in 2019

- **Rían Adamian** has already implemented **190 additional new unique features** this summer (comprising **422 new feature values**) :
 - 8 new pitch statistics features
 - 19 new rhythmic features
 - 112 new melody / horizontal interval features
 - 43 new chords / vertical interval features
 - 10 new instrumentation features
- **There are now 436 unique features in total**

Cory Monster want **MORE FEATURES!**



<https://register.myrunti.me/sesamestreerun/>

Features areas remaining to be more fully explored by jSymbolic

- **Local melodic transitions** longer than one horizontal interval and strings of horizontal patterns
- **Local chord transitions** and strings of vertical patterns
 - Current vertical features aggregate vertical intervals independently of what directly precedes and follows them
- **Local rhythmic transitions** and strings of rhythmic patterns
 - Current rhythmic features aggregate attacks, rhythmic values and rests independently of what directly precedes and follows them
- **Complex textural behaviour**
 - e.g. measures of imitation

Infrastructure needed to do this

- Note onset slices



<https://en.wikipedia.org/wiki/Salami>

- N-grams

Note onset slices (1/2)

- A slice consists of **vertical groups of notes sounding simultaneously**
- A new slice is started every time a new (pitched) **note attack** occurs
- There are various (non-deli) flavours:
 - e.g. a slice may only contain notes starting at the beginning of the slice
 - e.g. a slice may also contain notes held from previous slices
 - e.g. a slice may omit notes that are only held for less than some fraction of the slice

The image displays two musical staves, labeled 'A.' (Alto) and 'T.' (Tenor), illustrating note onset slices. The top staff (A.) is marked with a '5' above the first measure, and the bottom staff (T.) is marked with an '8' below the first measure. Both staves are in a key signature of one flat (B-flat major or F minor) and use a treble clef. Vertical dashed lines are drawn through the staves to indicate the onset of notes. In the Alto staff, the notes are: a dotted quarter note (B-flat), a half note (C), a quarter note (D), a quarter note (E), and a quarter note (F). In the Tenor staff, the notes are: a dotted quarter note (B-flat), a quarter note (C), a quarter note (D), a quarter note (E), and a half note (F). The vertical dashed lines align with the onset of each note in both staves, demonstrating how a slice is defined by the simultaneous onset of notes.

Note onset slices (2/2)

- Note onset slices provide **grouped units of notes** that permit the calculation of new features associated with:
 - Local harmonic transitions
 - Local melodic transitions
 - Local rhythmic transitions
 - Sophisticated textural behaviour
- Sets of such transitions can also be used to construct . . .

N-grams

- N-grams encode **sequences of n note onset slices**
- Can be related to:
 - Harmonic sequences
 - Melodic sequences
 - Rhythmic sequences
- **Examples:**
 - **7-6-8** is a **3-gram** showing the vertical intervals between outer voices
 - **[7] (1 -2) [6] (-2 2) [8]** is a **3-gram** that also encodes melodic transitions in the outer voices
- There can be many varieties of n-grams

30

(-2) (+2)

[7] [6] [8]

(1) (-2)

Current jSymbolic development status

- A variety of note onset slice and n-gram implementation are already implemented and **undergoing code review and testing**
- We are designing features we can extract from them
 - e.g. textural features
 - Such as density of imitation
 - e.g. features looking at general n-gram distributions
 - Such as histogram statistics
 - e.g. features looking at selected n-grams expected to be meaningful
 - Such as cadential patterns



to tell us about any features you think could be usefully added to jSymbolic!

Thanks for your attention!

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