CorpusVis: Visual Analysis of Digital Sheet Music Collections

Supplementary Material

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1. Prototype

We added this supplemental material to include an enlarged image of the teaser figure in the original paper as displayed in Figure 2. The prototype comprises five main components that are tightly connected through linking and brushing. While CorpusVis primarily aims at supporting music analysis at a higher level, the sheet view E only provides a quick visual reference to the underlying composition instead of supporting a full-blown analysis at this level. There are other tools such as MusicVis [MFH*22] that enable such low-level sheet music analysis. In the future, a seamless connection between these tools is planned and would support music analysts to investigate and explore musical compositions at both abstraction levels. In the settings menu at the top left of A, user can open a use case selector. CorpusVis provides multiple prepared use cases (see Figure 1) that can directly be loaded. This way, user can get acquainted with the prototype through preselected compositions and features.

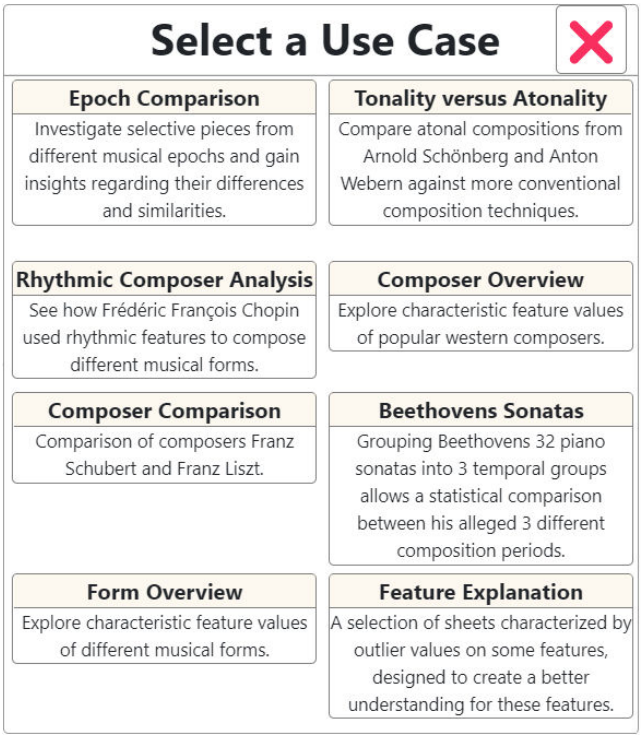

Figure 1: CorpusVis contains multiple prepared use cases that contain a preselected dataset and a specific set of selected features. These use cases help users to get started with analysis examples. Besides the provided use cases. Users can also create their own use cases by saving any status of the prototype using a custom title.

2. jSymbolic features: Pitch, Melody, Rhythm

The feature matrix component B provides 46 different low-level statistical features of single compositions or even higher level aggregations. As the extensive list provided in Table 1 is too detailed to provide it in the original manuscript as it surpasses the available page limit. Thus, we decided to provide the details about all musical feature via this supplementary material document for interested readers.

3. Introductory Teaser Video

Along with this supplementary document, we provide a teaser video, which introduces all components of CorpusVis through the exemplary use cases that are also presented in the paper. We recommend the reader to watch the entire video to learn how music analysts can interact with the prototype to execute an analysis. The video also shows the interactive introduction that we integrated in the application to enable users to understand every component in detail.

References

[MFH*22] MILLER M., FÜRST D., HAUPTMANN H., KEIM D. A., EL-ASSADY M.: Augmenting Digital Sheet Music through Visual Analytics. *Computer Graphics Forum* (1 2022). doi:10.1111/cgf.14436. 1

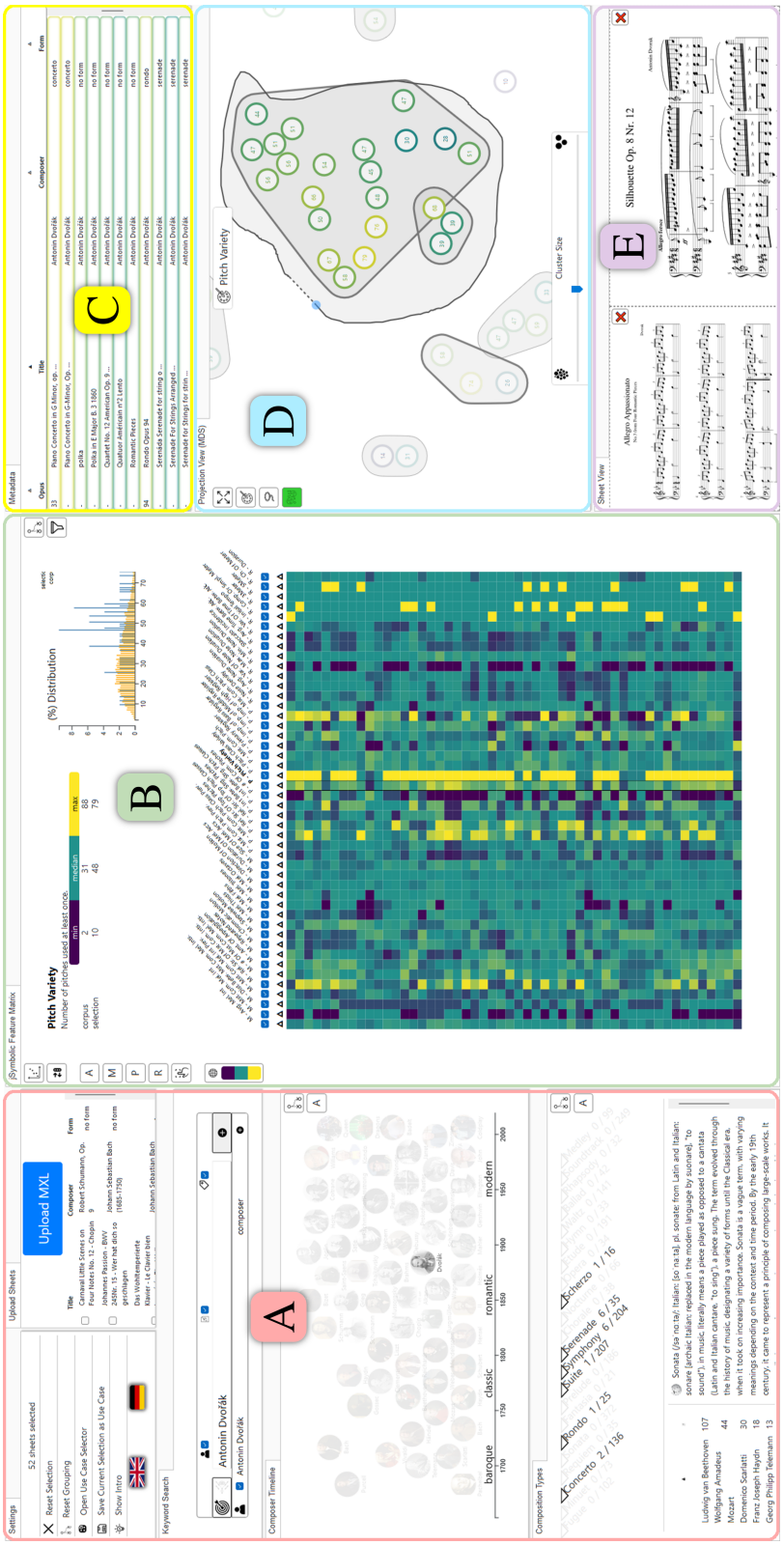

Figure 2: This figure is similar to the teaser figure of the corresponding paper. We added this figure to allow for a larger representation to better investigate the details of the components without the need to open the prototype CorpusVis. The application contains five main components: Selecting and filtering of compositions based on keywords and metadata A, the feature matrix B, the metadata table C, the MDS projection view D, and the sheet view E. The prototype primarly serves for an analysis at the more abstract level instead of focusing on single notes at the sheet level. Hence, CorpusVisis specifically useful to perform an analysis to identify high-level differences between compositions, composers, epochs, and music styles.

Type	Feature	Description
Metadata	Title	Title of the composition.
Metadata	Composer	Composer of the composition.
Metadata	Form	Musical form of the composition.
Metadata	Opus	Opus number of the composition.
Melodic	Amount of Arpeggiation	Fraction of horizontal intervals that are repeated notes, minor thirds, major thirds, perfect fifths, minor sevenths, major sevenths, octaves, minor tenths or major tenths.
Melodic	Average Melodic Interval	Average melodic interval (in semitones).
Melodic	Chromatic Motion	Fraction of melodic intervals corresponding to a semitone.
Melodic	Direction of Motion	Returns the fraction of melodic intervals that are rising rather than falling. Unisons are omitted.
Melodic	Distance Between Most Common Melodic Intervals	Absolute value of the difference between the most common melodic interval and the second most common melodic interval.
Melodic	Duration of Melodic Arcs	Avg. number of notes that separate melodic peaks and troughs in any part: calculated as the total number of intervals (ignore unisons) div. by the number of melody direction changes.
Melodic	Melodic Fifths	Fraction of melodic intervals that are perfect fifths.
Melodic	Melodic Octaves	Fraction of melodic intervals that are octaves.
Melodic	Melodic Thirds	Fraction of melodic intervals that are major or minor thirds.
Melodic	Melodic Tritones	Fraction of melodic intervals that are tritones.
Melodic	Most Common Melodic Interval	Melodic interval with the highest frequency.
Melodic	Most Common Melodic Interval Prevalence	Fraction of melodic intervals that belong to the most common interval.
Melodic	Number of Common Melodic Intervals	Number of melodic intervals that represent at least 9% of all melodic intervals.
Melodic	Relative Strength of Most Common Intervals	Fraction of melodic intervals that belong to the second most common interval divided by the fraction of melodic intervals belonging to the most common interval.
Melodic	Repeated Notes	Fraction of notes that are repeated melodically.
Melodic	Stepwise Motion	Fraction of melodic intervals that corresponded to a minor or major second.
Melodic	Size of Melodic Arcs	Average span (in semitones) between melodic peaks and troughs in any part. Each time the melody changes direction begins a new arc. The average size of melodic arcs is defined as the total size of melodic intervals between changes of directions - or between the start of the melody and the first change of direction - divided by the number of direction changes.
Pitch	Importance of Bass Register	Fraction of Notes between MIDI pitches 0 and 54.
Pitch	Importance of High Register	Fraction of Notes between MIDI pitches 73 and 127.
Pitch	Importance of Middle Register	Fraction of Notes between MIDI pitches 55 and 72.
Pitch	Interval Between Strongest Pitches	Absolute value of the difference between the pitches of the two most common MIDI pitches.
Pitch	Interval Between Strongest Pitch Classes	Abs. value of the diff. between the pitch classes of the two most common MIDI pitch classes
Pitch	Most Common Pitch	Bin label of the most common pitch.
Pitch	Most Common Pitch Class	Bin label of the most common pitch class.
Pitch	Most Common Pitch Prevalence	Fraction of Note Ons corresponding to the most common pitch class.
Pitch	Most Common Pitch Class Prevalence	Fraction of Note Ons corresponding to the most common pitch.
Pitch	Number of Common Pitches	Number of pitches that account individually for at least 9% of all notes.
Pitch	Pitch Class Variety	Number of pitch classes used at least once.
Pitch	Pitch Variety	Number of pitches used at least once.
Pitch	Primary Register	Average MIDI pitch.
Pitch	Relative Strength of Top Pitch Classes	The freq. of the 2nd most common pitch cl. divided by the freq. of the most common pitch cl.
Pitch	Relative Strength of Top Pitches	The freq. of the 2nd most common pitch divided by the frequency of the most common pitch.
Rhythm	Average Note Duration	Average duration of notes in seconds.
Rhythm	Average Time Between Attacks	Average time in seconds between Note On events.
Rhythm	Changes of Meter	Set to 1 if the time signature is changed one or more times during the recording.
Rhythm	Compound or Simple Meter	Set to 1 if the initial meter is compound (numerator of time signature is greater or equal to 6 and is evenly divisible by 3) and 0 if it is simple.
Rhythm	Duration	The total duration in seconds of the music.
Rhythm	Initial Tempo	Tempo in beats per minute at the start of the recording.
Rhythm	Maximum Note Duration	Duration of the longest note (in seconds).
Rhythm	Minimum Note Duration	Duration of the shortest note (in seconds).
Rhythm	Note Density	Average number of notes per second.
Rhythm	Quintuplemeter	Set to 1 if numerator of initial time signature is 5, set to 0 otherwise.
Rhythm	Staccato Incidence	Number of notes with durations of less than a 10th of a second div. by the total number of notes.
Rhythm	Triplemeter	Set to 1 if numerator of initial time signature is 3, set to 0 otherwise.
Rhythm	Variability of Note Duration	Standard deviation of note durations in seconds.
Rhythm	Variability of Time Between Attacks	Standard deviation of the times, in seconds, between Note On events.

Table 1: This table comprises all precomputed features that are available in the feature matrix visualization in CorpusVis. **M**elodic, **p**itch an **r**hythm features were extracted using *music21*. In the future, it would be easily possible to extend this list to support further analysis aspects.