Visual Musicology – At the Interface of Musicology and Visual Analytics

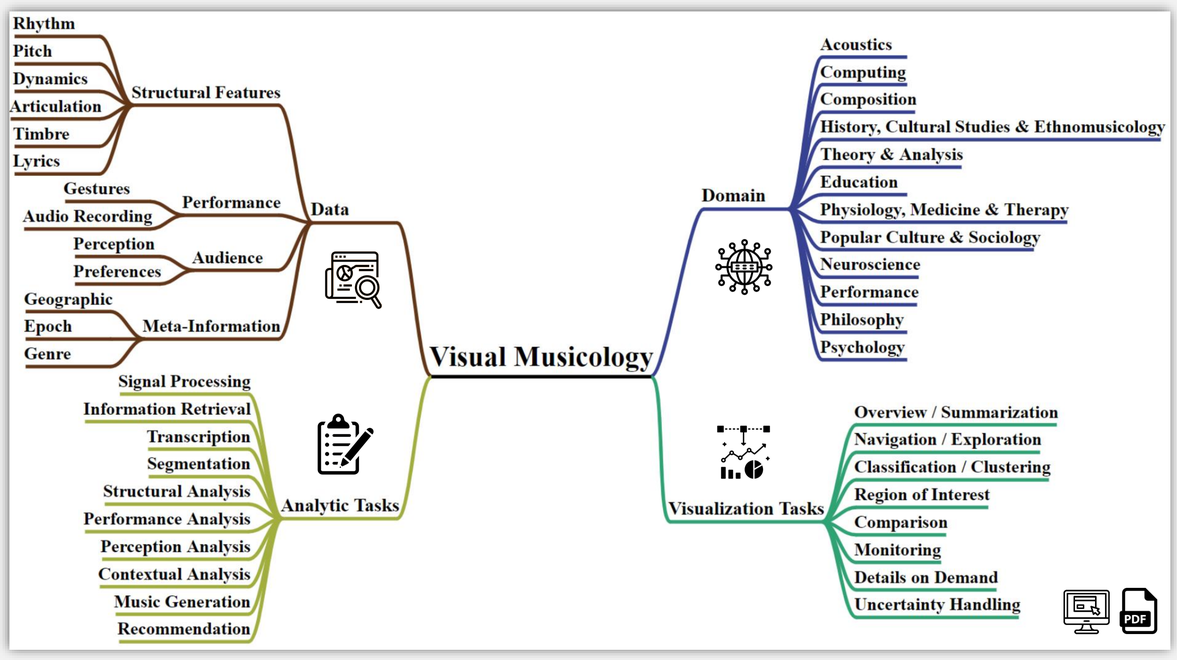

Matthias Miller
matthias.miller@uni.kn


Daniel Fürst
daniel.fuerst@uni.kn

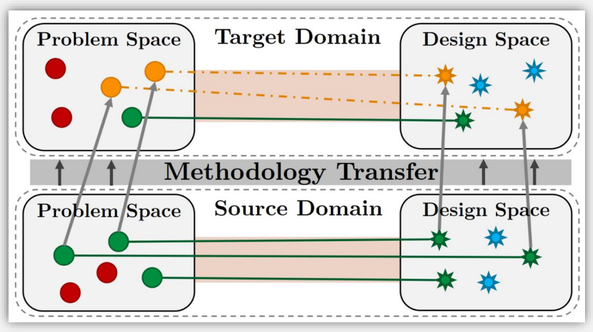

Julius Rauscher
julius.rauscher@uni.kn


Mennatallah El-Assady
melassady@ai.ethz.ch

Musical Characteristics, Domains, and Visualization Tasks

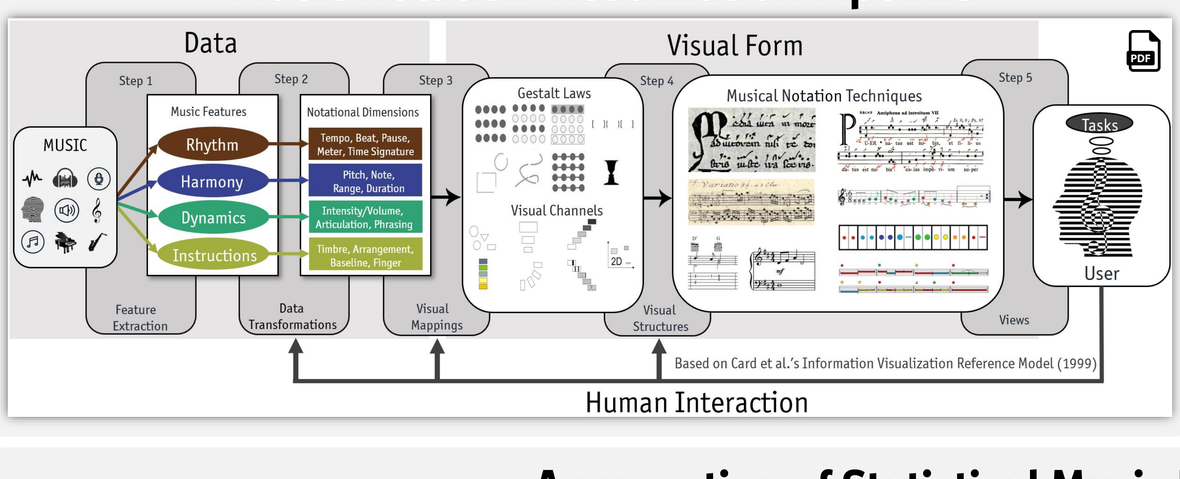


The Methodology Transfer Model

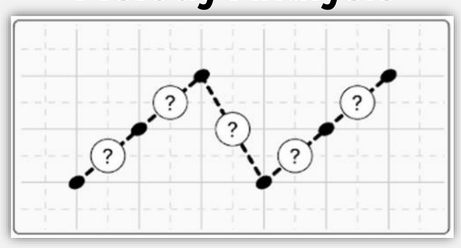


The Methodology Transfer Model (MTM) enables scientific researchers and domain experts to identify similarities in the problem and design space. In this way, existing solutions can be mapped between two different domains and applied on problems that still require a solution.

Music Notation Visualization Pipeline

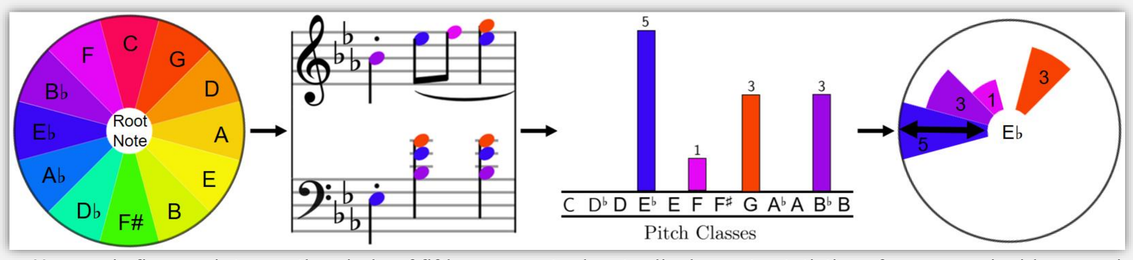


Melody Analysis



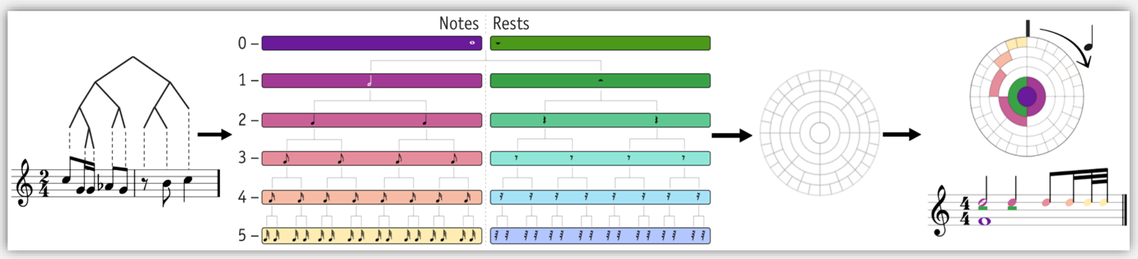
Melodic Patterns are a combination of pitch and rhythmic information. Melodic themes or motifs are the basic element of music that is very salient and typically remembered.

Harmonic Fingerprints



Harmonic fingerprints use the circle of fifths as a metaphor to display note statistics of measures inside a musical score. The radial representation enables the comparison of geometrical shapes between different chords.

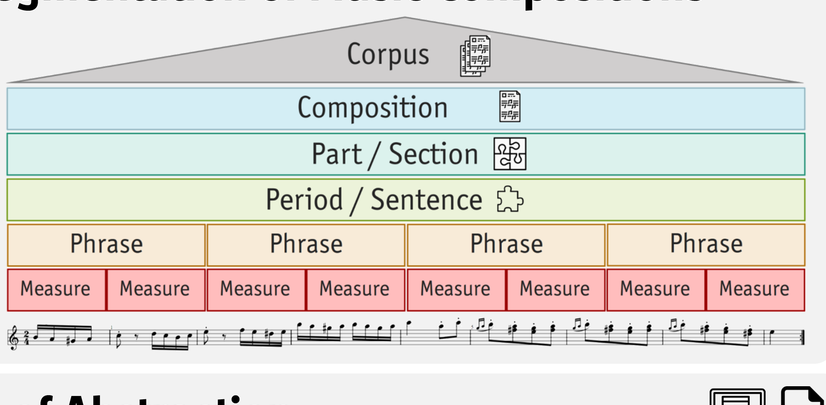
Rhythmic Fingerprints



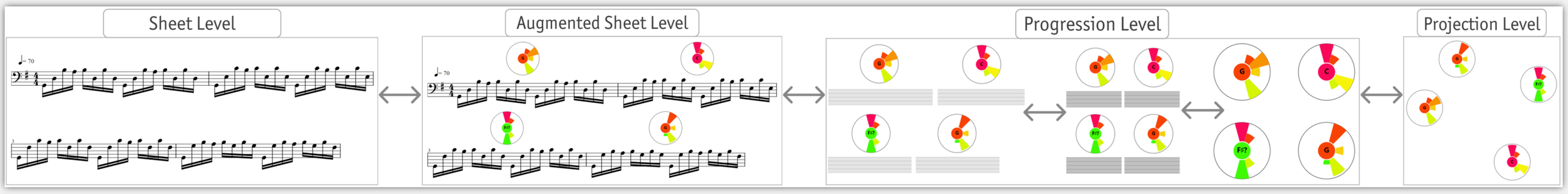
Rhythmic fingerprints reveal rhythmic patterns based on a pie chart metaphor using standard note durations. Notes of longer duration are at the center and shorter notes at the outer discs. Color supports identification.

Hierarchical Segmentation of Music Compositions

Composers use a well-defined segmentation to design the structure of their compositions. These levels can be used to analyze sheet music at different levels of abstraction starting at the measure or even note level progressing all the way up to the corpus level.

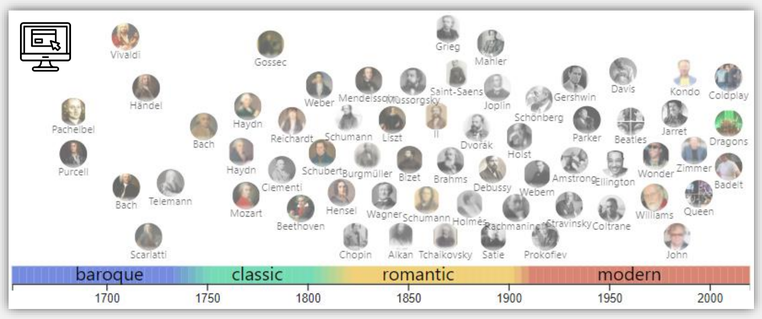


Aggregation of Statistical Music Data at different Levels of Abstraction

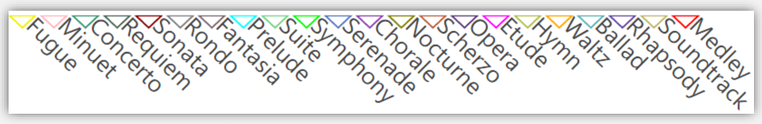


Different levels of abstraction allows analysts to investigate musical scores from various perspectives supporting tasks such as comparison or exploration.

Visual Exploration of Composer Data



Each composer has a specific epoch in which they did their life's work.

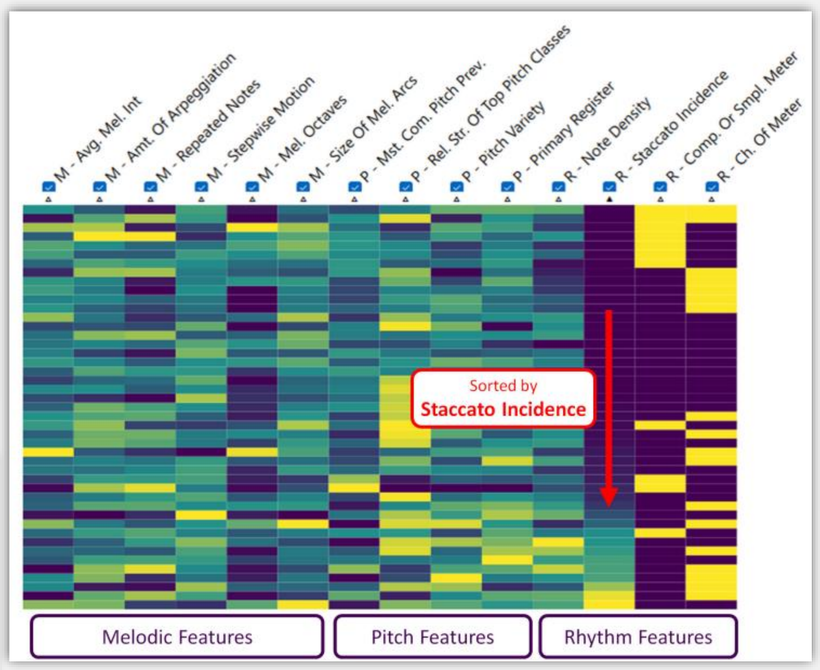


Musical works typically belong to a certain musical category: e.g., fugues.

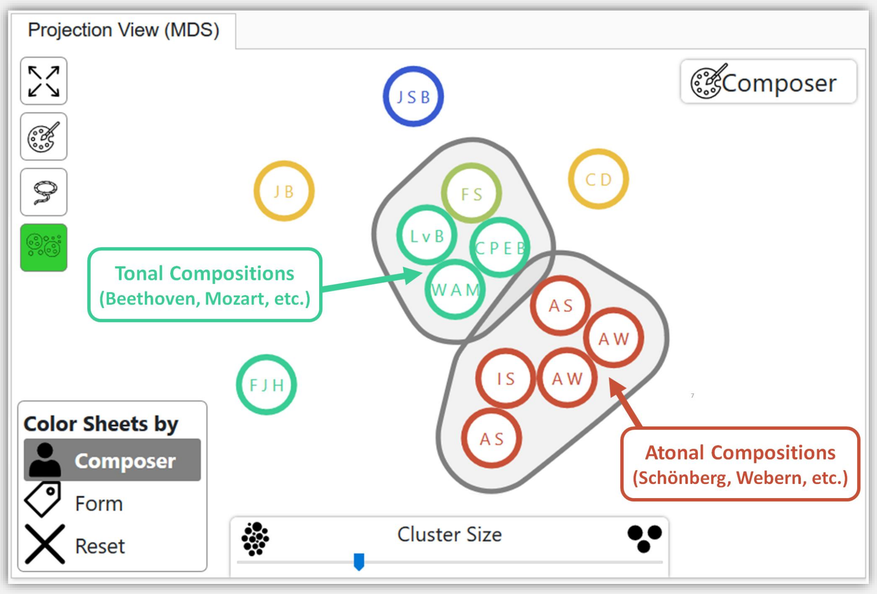
Metadata

Opus	Title	Composer	Form
3	Serenade from String Quartet, ...	Franz Joseph Haydn	serenade
0	Arpeggione Sonata	Franz Schubert	sonata
9	Nocturne in E Flat Major Op. 9 ...	Frédéric François Chopin	nocturne
0	The Firebird (part 3)	Igor Stravinsky	no form
0	Minuet in G Major BWV Anhang 1 ...	Johann Sebastian Bach	minuet

Exploring and sorting sheet music based on metadata.



The feature matrix allows music analysts to compare single compositions or grouped collections based on musical features from different categories.



Leveraging data transformations such as multi-dimensional scaling are a famous data analysis technique to prepare two-dimensional visualizations for comparison and identification tasks. Different visual variables such as shapes, colors, size, or position are utilized to facilitate the visual analysis to improve the understanding of complex data. In this example, color is used to encode to which epoch a composer belongs. In this example, tonal compositions can be easily distinguished from atonal pieces.

[1] **M. Miller**, D. Fürst, H. Hauptmann, D. A. Keim, M. El-Assady. **Augmenting Digital Sheet Music through Visual Analytics**. Comput. Graph. Forum, 2022
[2] **M. Miller**, J. Rauscher, D. A. Keim, M. El-Assady. **CorpusVis: Visual Analysis of Digital Sheet Music Collections.** Comput. Graph. Forum, 2022
[3] **M. Miller**, H. Schäfer, M. Kraus, M. Leman, D. A. Keim, M. El-Assady. **Framing Visual Musicology through Methodology Transfer**. VIS4DH Workshop at IEEE VIS, 2019
[4] D. Fürst, **M. Miller**, D. A. Keim, A. Bonnici, H. Schäfer, M. El-Assady. **Augmenting Sheet Music with Rhythmic Fingerprints**. VIS4DH Workshop at IEEE VIS, 2020
[5] **M. Miller**, A. Bonnici, M. El-Assady. **Augmenting Music Sheets with Harmonic Fingerprints.** ACM Symp. on Document Engineering, 2019
[6] **M. Miller**, J.H, M. Kraus, D. A. Keim, M. El-Assady. **Analyzing Visual Mappings of Traditional and Alternative Music Notation.** VIS4DH Workshop at IEEE VIS, 2018