Visual Pattern Analysis using Digital Sheet Music

Matthias Miller, Hanna Schäfer, Alexandra Bonnici, and Mennatallah El-Assady

Harmony Pattern Detection

Analyzing harmonic relationships based on sheet music is a common task for musicologists. We propose a visual application to analyze the harmonic characteristics based on sheet music. It comprises a flexible multi-view interface to support music analysts in identifying recurring patterns. We enable the viewer to display harmonic fingerprints for single bars to facilitate the understanding of the notes distribution in single bars as well as the identification of similar musical sections.

Visual Musicology[1] Context

The frame of *Visual Musicology* comprises all musicological areas and analytical tasks that can benefit from visualization tasks such as *overview*, *exploration*, *comparison*, and *details on demand*. Our harmonic fingerprint visualizes *Pitch Data* to support *Structural Analysis.* The presented web-application enables the investigation of sheet music in the domain of *Theory & Analysis*. We plan to improve our current prototype by adding new features such as *melody pattern search, performance,* or *meta information.*

(a) Import MusicXML

The music analysts can upload any sheet music of interest to the application if it is available based on the MusicXML file format. After the upload of the digital information, the system automatically processes the input and lists repetitive in the Highlights View and displays it in the Analysis Window using standard music notation.

(b) Playback View

Listening to the displayed piece facilitates the understanding of the visual information. There are many ways how to perform a piece, which depends on the interpretation of the musician. Still, the underlying harmonic must be consistent and allows users to understand why parts sound similar, although the visual information is different.

(c) Highlights View

The Highlights View shows repetitive music notes sequences ranked by frequency. If the viewer selects a pattern, all occurrences are highlighted in the Analysis Window using a light blue color. In this way, we support users to better understand the harmonic relationships of a musical piece in more detail.

(d) Analysis Window

The main component reveals the detailed information of the music sheet based on Common Music Notation in the Analysis Window. The usual sheet is extended with harmonic fingerprints to support visual analysis of harmonic similarities in the piece. The user can hover the fingerprints' pie elements to analyze the distribution.

(e) Harmonic Fingerprint

Our algorithm calculates the distribution of all notes weighted by duration and displays a radial pie chart based on the circle-of-fifths revealing dominant pitch classes. At the center, the chord (e.g., major/minor) is given for each bar. Also, the visualization allows to identify harmonic parallels between different bars.